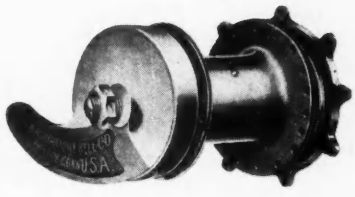
EERING
RARY

JUL 1 6 1945

AUTOMOTIVE and Aviation INDUSTRIES

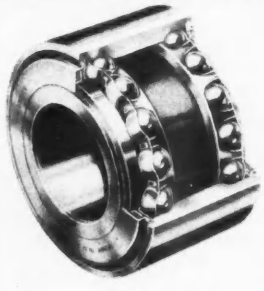
JULY 1, 1945

FAMOUS "FIRSTS" by NEW DEPARTURE

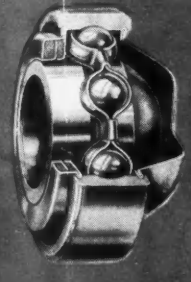


First Bicycle Coaster Brake

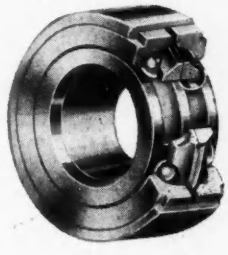
First Yellow Taxicab



First Self-Sealed Lubricated-for-Life Mine Car Bearing

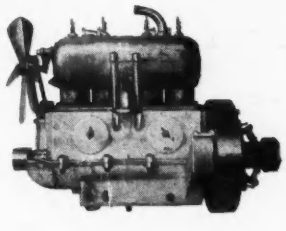


First Conveyor Roll Bearing



First Dual-Purpose Ball Bearing

First Self-Sealed Bearing Lubricated-for-Life



First Engine with Cylinders Cast en Bloc

First Successful Treadle Roll Bearing for Textile Looms

First Fan and Pump Shaft Bearing Self-Sealed and Lubricated-for-Life

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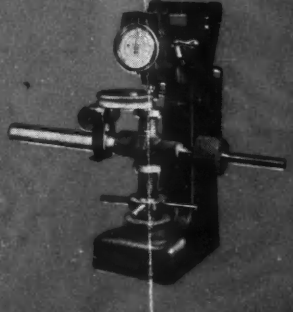

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BALL BEARINGS

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To help you protect your own and Uncle Sam's machine tools

THERE'S no need to tell most plant men that rust prevention has become a major problem to protect parts during production or in shipments. It will be increasingly important as machines are laid up temporarily or stored for Uncle Sam according to government requirements.

To help you in this job, Standard Oil Lubrication Engineers are ready to give you the benefit of their experience gained in working for other plants who have had the problem before you. These Engineers also have many of the rust preventives called for in government instructions for protecting machines and parts. They can save you the trouble of "shopping around" to find those you must use.

You can reach one of these Engineers by calling the nearest local Standard Oil Company (Indiana) office, or writing 910 South Michigan Avenue, Chicago 80, Illinois.

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This booklet lists rust preventives that meet government specifications, which Standard Oil can supply. It gives the Army, Navy or Ordnance specifications under the product name and Standard Oil's brand number, with a very brief description of the use and methods of application of each rust preventive.

You can get a copy of this booklet from the Standard Oil Industrial Representative who calls on you or by writing Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Volume 93 July 1, 1945 Number 1

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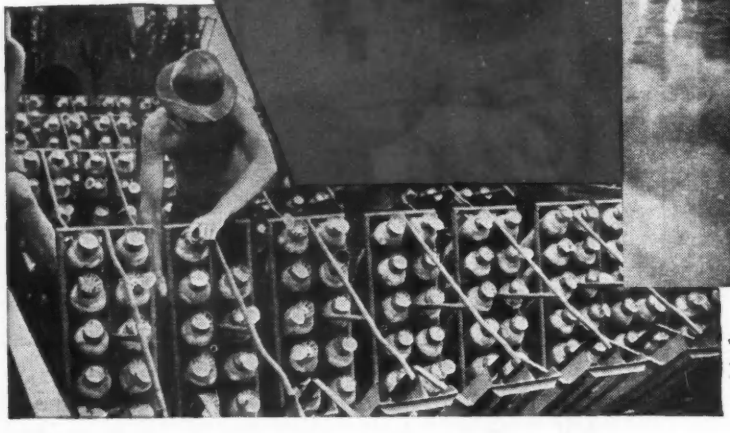
METAL... WORKING!



Rocket bombardment of Pacific island. Photo at left shows one of the rocket firing racks being loaded on the deck of an LCI.

"BAZOOKA BOATS" is the Navy's nickname for these rocket-firing landing craft. Here indeed is "hot" metal — working to knock out enemy defenses just before our invasion troops swarm ashore. Rocket projectiles are so effective for many jobs that the navy has budgeted nearly $100,000,000 a month for them — as much as previously spent for all other types of naval ammunition combined.

In stepping up production to meet this tremendously increased demand, the metal working industry knows that faster machining must still go hand-in-hand with accuracy — and this can be done only through the use of highly efficient cutting fluids.

Texaco Cutting and Soluble Oils not only assure faster machining, but better finish and longer tool life as well. That is why they are the choice of experienced machine tool operators everywhere.

Texaco cutting fluids cool and lubricate the tools, carry away heat and prevent chip welding — thus prolonging tool life, reducing down-time for tool changes, assuring greater output.

The services of a Texaco Engineer specializing in cutting coolants are available through more than 2300 Texaco distributing plants in the 48 States. Get in touch with the nearest one, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

RECONVERSION RUSTPROOFING

5 Points to Remember

1. Upon termination of war contracts, Government-owned production equipment must be rustproofed promptly, in accordance with *official instructions.*
2. Ordnance Specification P.S. 300-4 contains *official instructions* for the complete processing of such equipment.
3. These instructions require that only rustproofing materials meeting Government specifications be used.
4. *Texaco rustproofing products meet Ordnance specifications for application on Government-owned equipment.*
5. For full information, see your Texaco representative or write to us.

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TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT—CBS

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the first and 15th of the month

July 1, 1945
Volume 93, No. 1

Prices, Profits and Production

By Charles S. Davis
President, Borg-Warner Corp.

As CHESTER BOWLES put it, "The Central principle of price control, is cost absorption." That principle denies business the right to raise its prices to offset unavoidable increases in production costs. It requires business to absorb cost increases out of its profit margins. It results in a shrinkage or even disappearance of the margins on many products. The Price Administrator defends the cost absorption policy by insisting that over-all wartime profits have been satisfactory, and we have maintained unprecedented levels of production and employment. But that argument doesn't prove his case.

The facts are, that much of the profit has been earned on Government orders of war goods, themselves exempt from OPA pricing, although some of their components are covered by price ceilings; it is war production, not civilian industry, that is providing the increased employment. OPA cannot claim credit for what industry has done outside of, or in spite of, its restrictive policies.

The Price Control Act was designed to assure *fair and equitable prices,* despite the wartime impact of too much money on too little goods. A fair and equitable price means, at the very minimum, a price which covers all production costs—including the profit cost of capital facilities. But the OPA, under its policy of cost absorption, arbitrarily refuses to price specific products on this fair basis. It deliberately squeezes profit margins.

America grew to greatness by providing soil in which a man with an idea, a little capital, and courage, could plant a small business and make it grow into a big one. We want that opportunity again. Our returning service men—ambitious and self-reliant—demand it. But we won't have it, under the OPA policy of cost absorption, with its squeezing of profit margins. It is the potential new businesses that will be most discouraged by the perpetuation of that policy. New businesses cannot start—they cannot get the needed venture capital—when profit prospects are lacking.

American business is determined to build postwar prosperity for all Americans. It has the management know-how which, combined with the best labor force and the best capital facilities every known, can do that job. Private business cannot continue to produce and provide jobs on a handout basis; nor can it long continue to employ labor and capital in the production of goods that cannot be sold at prices high enough to cover all costs, including a fair profit margin to those who supply the capital facilities.

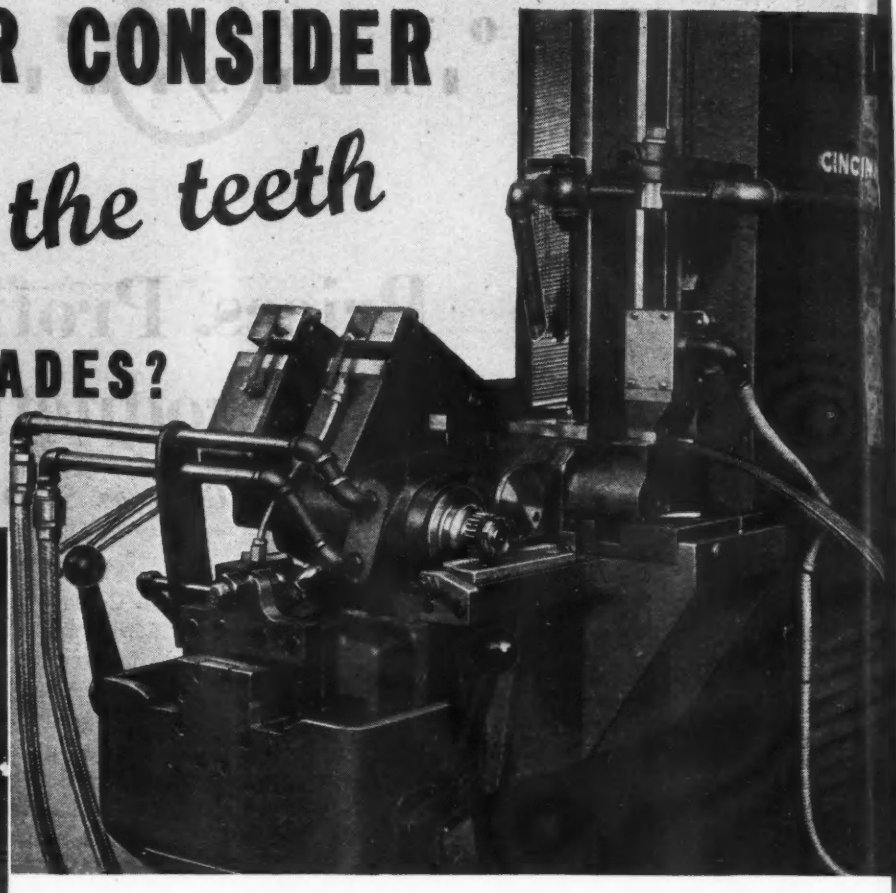
Business must meet its expenses out of its income from goods produced and sold. It has no power to recover its losses by compulsory levies. Unlike Government, it has no power to tax. But there is one compelling advantage in the kind

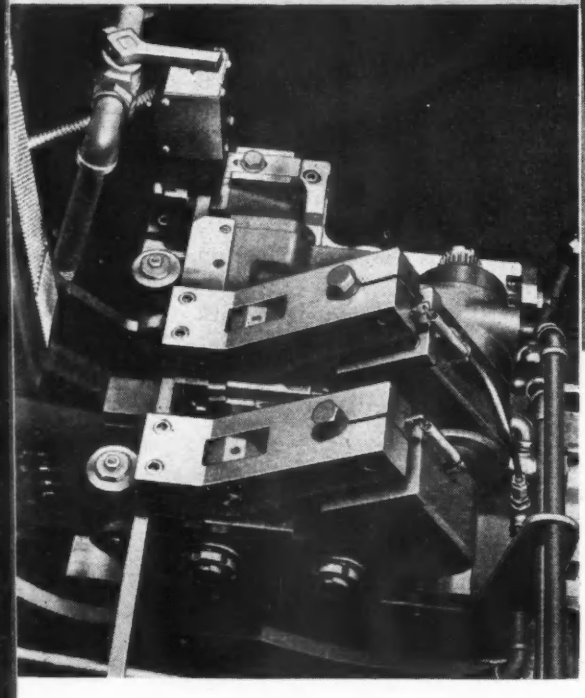
(*Turn to page* 70, *please*)

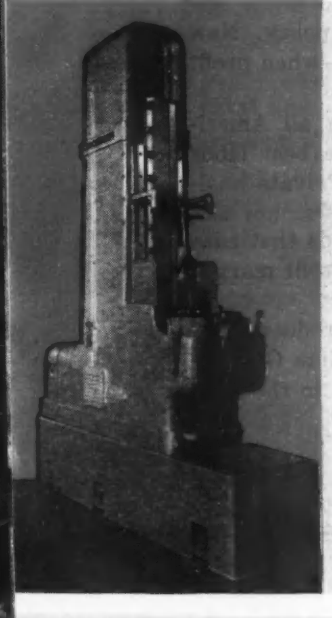
DID YOU EVER CONSIDER

broaching the teeth

IN BAND SAW BLADES?







New CINCINNATI No. 3-48 Single Ram Vertical Hydro-Broach Machine. Complete specifications may be obtained by writing for catalog M-1389. (For the new Duplex machine, write for catalog M-1387)

Here's an idea that may prove of value to you in cutting the teeth in hack saw blades, band saw blades, or any other long part or blank stock requiring repetitive cuts along one edge.

The machine is a CINCINNATI No. 1-30 Single Ram Vertical Hydro-Broach, with receding work table, equipped with combination hydraulic and electrically controlled work holding fixture. A number of strips are stacked vertically, depending upon their width and thickness. The operating cycle consists of:

1. Ram descends, broaching 2" wide cut.
2. Table retracts to "clear" position.
3. Ram returns to starting position. During this time, the work is unclamped, automatically shuttled sidewise and reclamped.
4. Table advances to cut.
5. Ram descends and cycle repeats.

At conventional ram speeds, the machine can produce 321 cuts per hour, or *2.43 miles of blades in 24 hours.*

While this idea was originally worked out for band saw blades, it may have many more applications . . . perhaps right in your own shop. Our engineers will be glad to talk broaching with you.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

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Dr. R. P. Dinsmore,
Vice President,
Goodyear Tire & Rubber Co.

The Supply of Tires

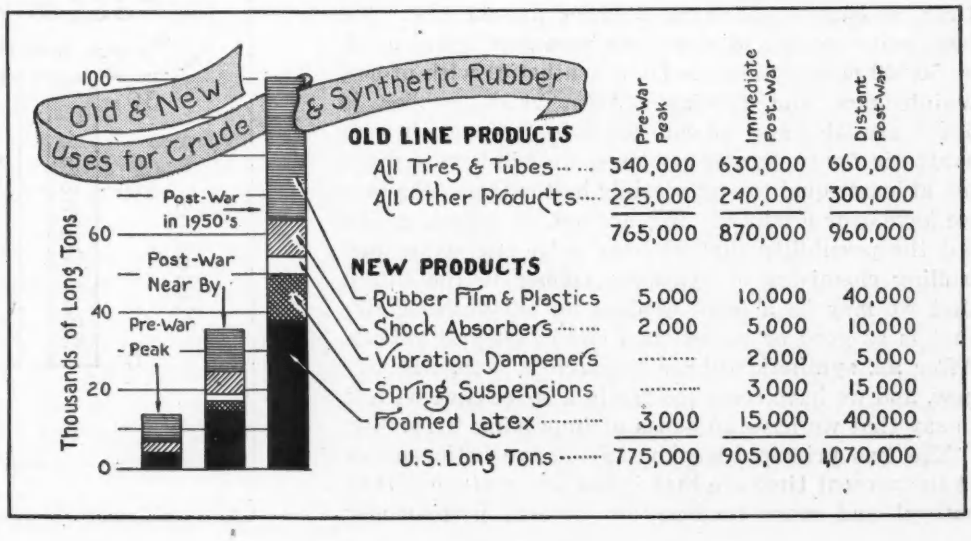
and Other Rubber Products for Postwar Vehicles

THE tire industry confidently expects to be able to furnish the necessary tires for new automobiles when they start rolling off the production lines. We say that because we believe that the cutbacks in war programs carried on by the car manufacturers will be followed by related reductions in the number of tires we will be expected to build for the military services. As a result, when the automobile industry is in shape to resume car production, we will have available the facilities, material, and manpower to "shoe" the cars as fast as they are built.

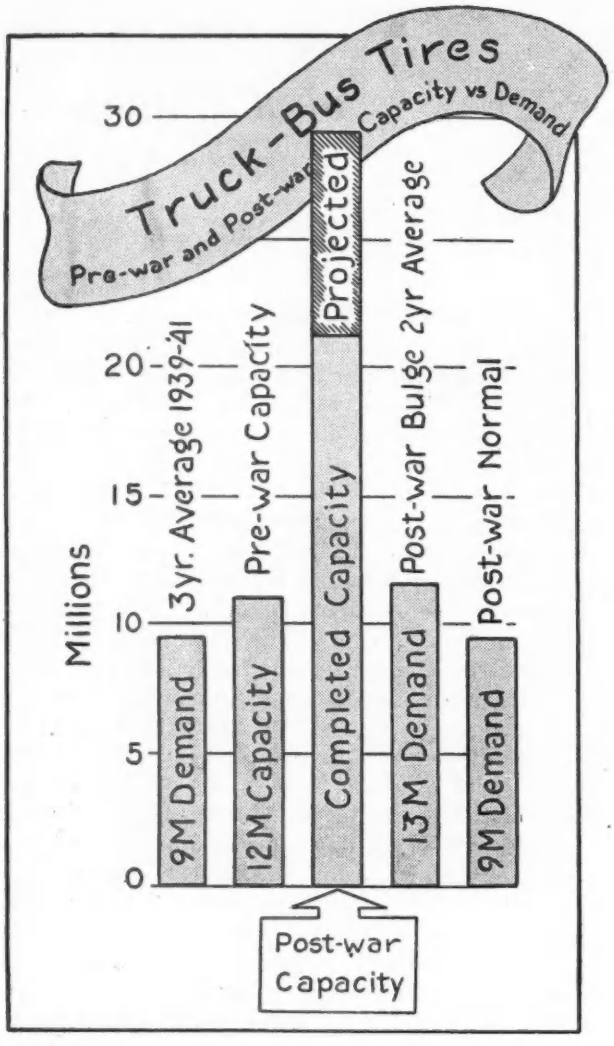
It is true that no one can predict just what is going to happen in the way of military requirements, but it is logical to expect that with the war in Europe a matter of history, the inordinately heavy pressure for truck and combat tires will abate somewhat. We have been trying for some time to get a realistic estimate of military requirements, and although we have had no final word, we are hopeful that we soon will have news of a more substantial cutback.

To get an idea of what a reduction in truck tire schedules would mean to the passenger car tire situation, let's take a look at the heavy-duty tire program. At the present time, the industry is turning out these tires at the rate of between 22 and 23 million units per year. Current facilities under construction will project this figure to approximately 24 million by the end of this year and to 29 million by the end of 1946 if completed. When we remember that in the three years just before the war we built only an average of nine million truck tires, we can see that the industry is already overexpanded during the war to a ratio of about 2½ to 1, and if the production projects now underway are completed, the ratio will be over 3 to 1. Impressive as these figures are, however, they do not tell the whole story. The most significant factor is that the current production ratio of large truck to passenger car tires is about 5 to 1. Consequently a reduction in schedules of only one million of these large units would free capacity for building five million passenger car tires—enough to equip 1½ million cars if no spare is supplied, or one million with five tires. This is enough to equip about one-half the number of cars expected to be built during the first year of automobile production. As a matter of fact, the tire industry is frankly concerned about the overexpansion of facilities during the war, and is suggesting that all present construction of new facilities be stopped at once. Present facilities are adequate to process available critical materials needed for all types of tires, and that is why we say that the military must make a critical re-appraisal of its needs to avoid overreaching and to avert wrecking the industry.

We have had our production problems rather consistently and they have been shadowy and shifting. One time it is rubber, next time it may be manpower, carbon black, cord, or something else. However, these are getting into better balance with present capacities, and we expect a reduction in our difficulties.



	Pre-War Peak	Immediate Post-War	Distant Post-War
OLD LINE PRODUCTS			
All Tires & Tubes	540,000	630,000	660,000
All Other Products	225,000	240,000	300,000
	765,000	870,000	960,000
NEW PRODUCTS			
Rubber Film & Plastics	5,000	10,000	40,000
Shock Absorbers	2,000	5,000	10,000
Vibration Dampeners	.....	2,000	5,000
Spring Suspensions	.....	3,000	15,000
Foamed Latex	3,000	15,000	40,000
U.S. Long Tons	775,000	905,000	1,070,000



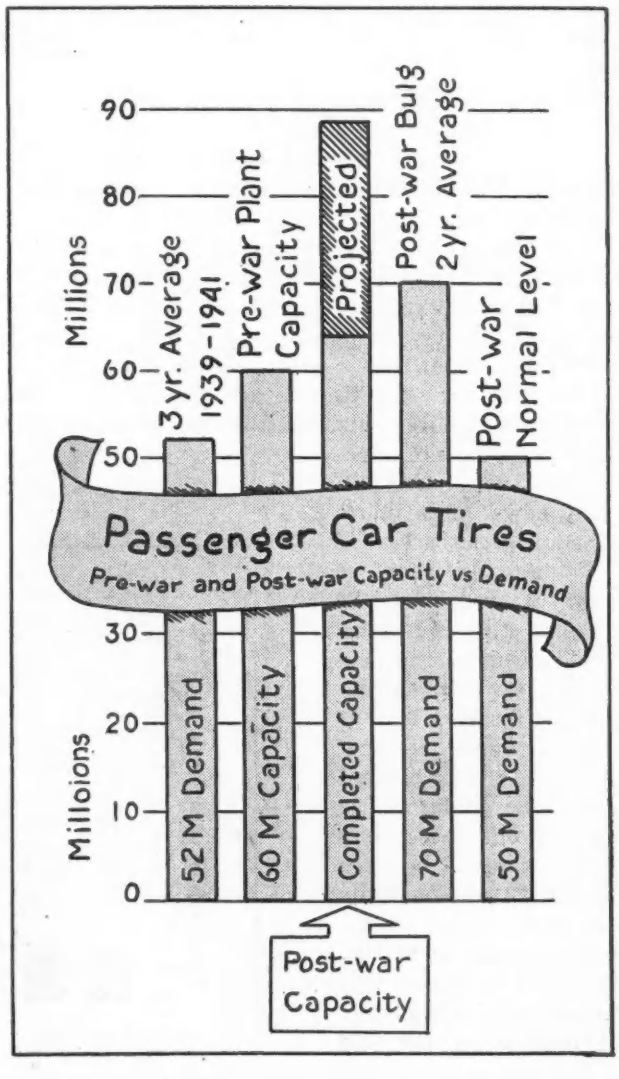
Enough facilities are available, manpower should free up with further war production cutbacks, and materials should become less of a problem as war needs decline.

Present indications are that passenger car tires for at least the first year will continue to be built 100 per cent of synthetic rubber. We are not greatly concerned about this because, while we are not prepared to say that they are equal to natural rubber, we have adequate evidence during the war that they are good tires, at least equal to the *average* prewar tire. We have many reports of users who have received as much as 55,000 miles of service from synthetics with proper maintenance and driving. When crude rubber is again available and we can use it in conjunction with synthetic for passenger car tires, we will have a product at least equal to—or possibly better than—the *best* we have ever produced. We are not, of course, ruling out the possibility that we may solve the secret and baffling chemistry of synthetic rubber to the extent that we may be able to produce an all-synthetic tire that is as good or better than one of natural rubber. After all, synthetic rubber research is comparatively new, and we have come too far in a short time with it to say that we have no hopes of improving it further.

The two principal weaknesses of synthetic rubber at the present time are that it has less resiliency than natural and more tendency to deform permanently under pressure. On the other hand, it is better than natural in its resistance to effects of oil and acids and in its ability to withstand extreme cold without stiffening. In any event, we will have to hold on to our synthetic rubber industry for two principal reasons: 1. To prevent a threat to our economic or military security through seizure by an unfriendly nation of the strategic rubber-growing areas of the world, and 2, to prevent, so long as we can produce synthetic rubber at reasonable cost, gouging of the American public by nations or cartels controlling the source of natural rubber.

The industry also is working on and will develop more rubber and plastic products to improve the post-war car. The three principal ones to date are vinyl chloride plastic fabrics, foamed latex for seat cushions, and rubber spring suspensions to replace steel springs. Other uses will be for vibration dampeners, shock absorbers, and for ingredients in lacquers, plastics, and adhesives.

The plastic fabric is a cast film derived from vinyl chloride. It is cut into strips slightly less than an inch wide, then tensilized, after which it is twisted and woven on conventional textile mill equipment. The weaving process permits the same range of colors and designs that are possible with other fabrics.



Its advantage, however, lies in its resistance to detergents, oils, greases, and stains of all kinds, and to many acids. All that is necessary to clean it is to wipe it with a damp cloth, which restores all the original luster. Although not fireproof, the material is flame resistant and is potentially longer-wearing than any other fabric known. Because of the high priority on vinyl chloride, very little is likely to be available until after the war.

Another possibility is the coating of textile fabrics with vinyl chloride. Here all the desirable characteristics of woven vinyl chloride fabrics are retained. It is very hard to say which of the two products—woven fabric or the calendered fabric—is preferable for automobile upholstery. Both have very good prospects for postwar cars. While the woven product is more costly, the treated fabric probably would compare very favorably with conventional upholstery fabrics. We have worked with automotive development engineers on these products and they have been receptive, but have many features to investigate.

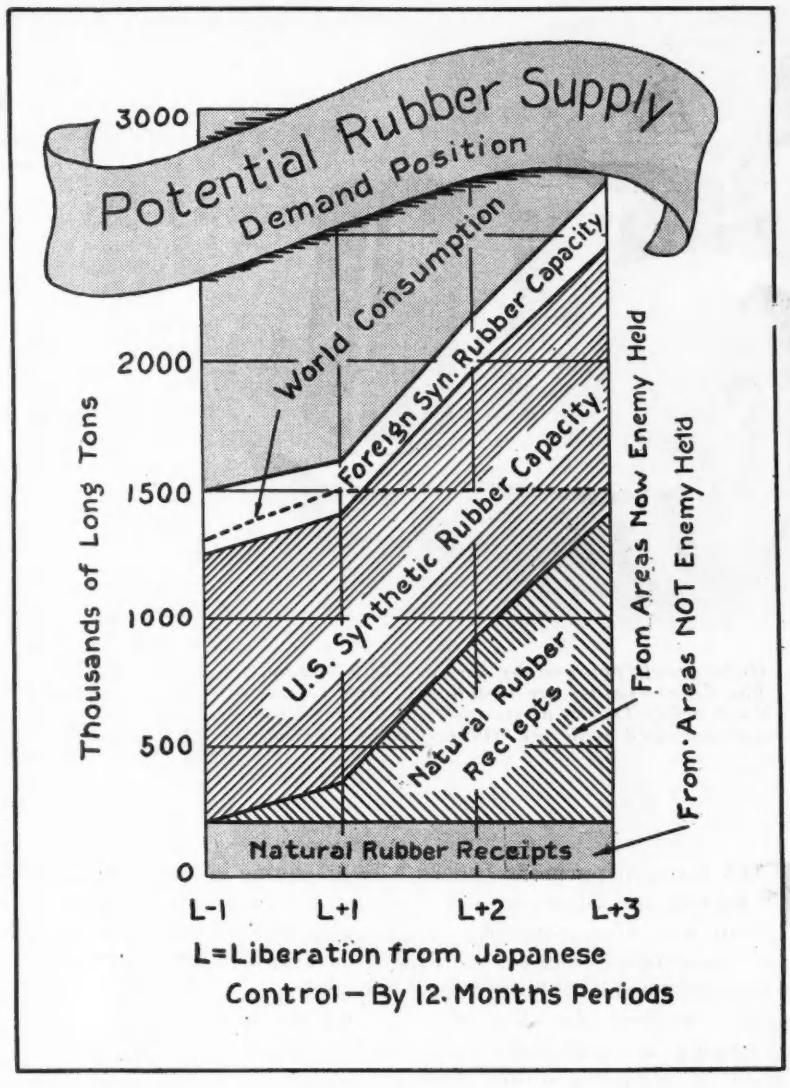
We also have done some development work on rubber suspensions for automobiles. We believe that this method of suspension has real merit and will be used ultimately. It would give more universal motion, reduce the overall weight, and provide better control of riding qualities. With the synthetic rubber industry after the war stabilizing the price of rubber, we can go ahead and engineer such developments, knowing that the price will not get out of control and make such projects uneconomical. Synthetic rubber also will be used in greater degree for such parts as motor mounts, hose connections, ignition wiring, and other parts which are subjected to heat and oil. It also will be used, in connection with some of the plastics, for window stripping and for gaskets as well as a number of other applications.

Foamed latex was used for seat cushions to a limited degree in some cars before the war, and we believe it is destined to come into more universal use because it gives remarkably restful riding qualities. Here, again, synthetic rubber can be used, although it must be handled a little more carefully during installation because it tears more readily than the natural product.

One of the most interesting developments is the growing use by commercial truckers of the wide base rim, providing a rim width equivalent to 70 per cent of the cross section of the tire. We believe this is the modern rim, and that when all truck manufacturers adopt it, tire performance will be the best we have ever seen. There also is a trend toward use of the wider rim on the coming models of passenger cars.

While cotton cord probably is here to stay, we undoubtedly will see increased use of rayon cord in tires, especially if we continue to use large percentages of synthetic rubber, because it makes for a cooler running tire. There has been some nylon cord used during the war, particularly in aircraft tires. However, this material not only is more costly, but it also has a tendency to "grow" when the tire is first placed in use, causing a weakening of the casing. Before it will become much of a contender, this characteristic must be overcome, and the price must be brought down.

One of the results of wartime driving is that motorists have become educated to the economies of recapping their tires. In the postwar period, this may possibly mean the elimination of second, third, and fourth line tires, or at least the third and fourth line products, because instead of buying one of the lower grade casings, the motorist will find it more economical to buy a top grade tire and have it recapped when the tread wears down. Our surveys show that among truckers especially, recapping will be much more prevalent than before the war. According to the best figures we can get, more than 60 per cent of all truck owners will use recapping, with the only exceptions being those operating at high speed or on long hauls.



Automotive D

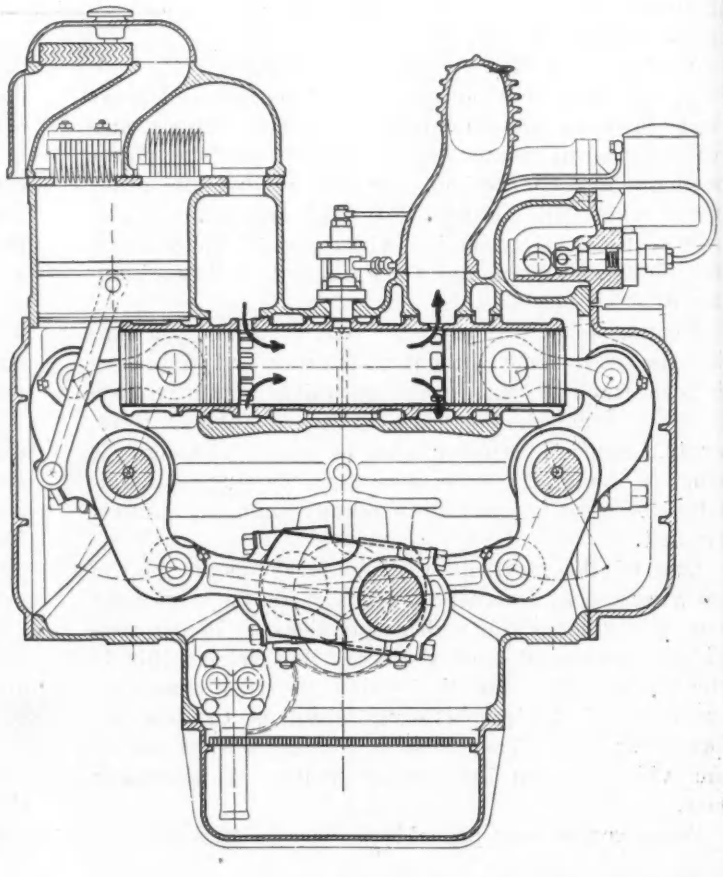
By Richard Herold
President, Sulzer Bros., Ltd., New York

Hofer truck powered by 66-hp. 2ZG9 engine. The 2ZG9 engines are installed in five- to six-ton trucks. Trucks of six- to eight-ton capacity are equipped with the 100-hp. 3ZG9 engine.

For traction purposes, where a light engine is essential, the Diesel suffers from its weight disadvantage when compared to the gasoline engine. If a two-stroke Diesel can be used, this disadvantage is reduced considerably. At the high engine speeds required for low weight, uniflow scavenging is imperative and can be obtained by replacing either inlet or exhaust ports, used with loop scavenging, by poppet valves in the cylinder heads. One of the main advantages of the two-stroke Diesel, freedom from poppet valves, is thereby given away. Another method for providing uniflow scavenging without going back to poppet valves, is to adopt the opposed-piston design. First used in steam engines and large low speed marine Diesels, the opposed-piston design has fought its way into Diesels for submarines, locomotives and even airplanes.

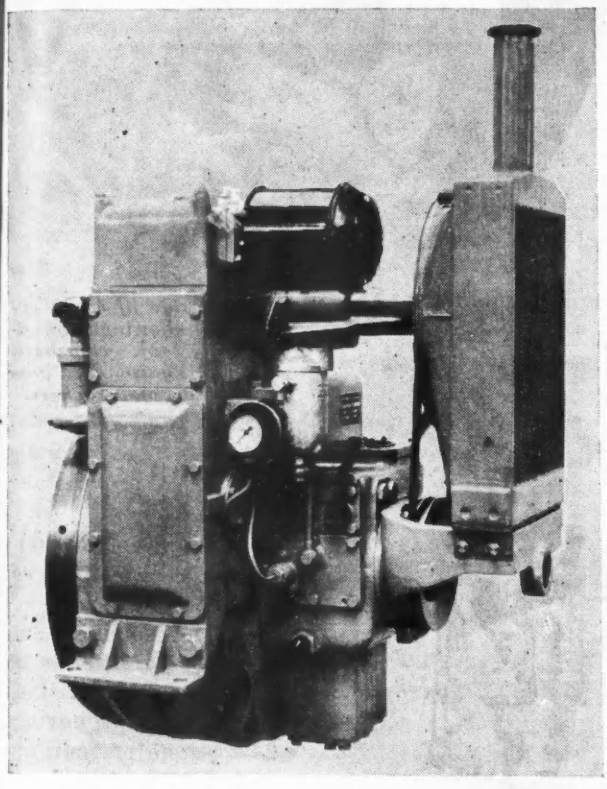
Sulzer Bros., who are best known for their large marine Diesels, have brought out a line of small, versatile two-stroke opposed-piston engines, ranging from 15 to 180 hp. The cylinders are horizontal and are fitted with interchangeable water-cooled cast iron liners; a metal to metal seal, without gaskets, is provided. Each cylinder holds two pistons which uncover, respectively, inlet and exhaust ports. The forces are transmitted, over rocker arms, to a single crankshaft located underneath the cylinders. The scavenging and charging air compressors—one for each cylinder are driven from the rocker arms of the scavenge-side pistons. The gear driven camshaft forms, with its housing, a detachable unit designed as an accessory box, which contains fuel cams and fuel pumps, governor, speed control, lubricators and, where required, starting air valves. Starting is by hand or electric for one- and two-cylinder engines, electric or by air for the larger units.

The fuel injectors are inserted in the top of the liners. In this connection, it may be well to dispel the erroneous notion that the two-stroke opposed-piston engine is complicated, a notion created by the fallacious consideration that each cylinder has to have two pistons instead of one. Actually, as each piston



Cross section of Sulzer two-stroke, opposed-piston Diesel.

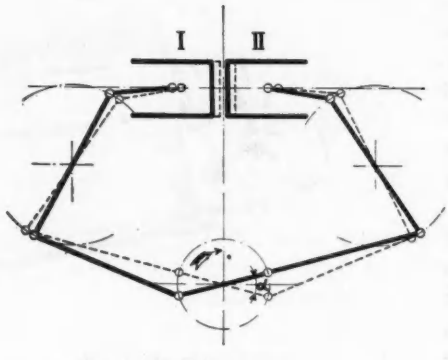
Diesels *of the Two-Stroke Horizontal-Opposed-Piston Design*



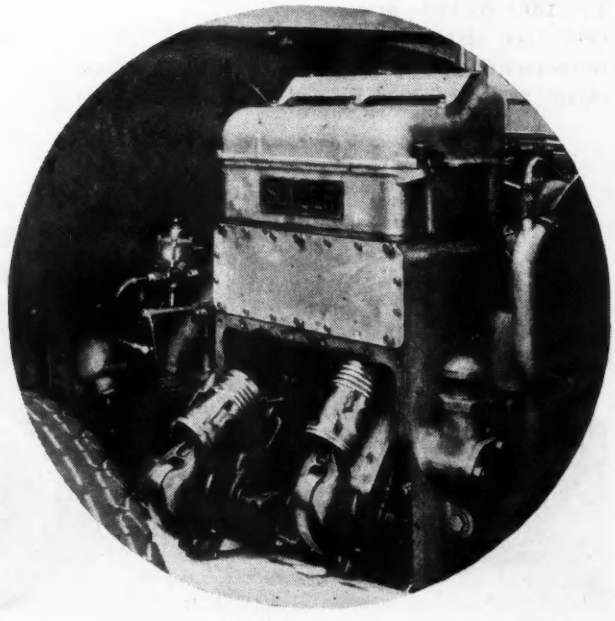
(Above) One-cylinder stationary Diesel, 15-hp. at 1500 rpm.

has a normal full length stroke, the opposite is true. For each two pistons there is only one cylinder, one fuel pump, one fuel injector and there are no cylinder covers. The number of many delicate parts is thus cut in half. Combining the work of two cylinders into one reduces weight and makes for compactness. The small Sulzer Diesel is, therefore, lighter than other types of equivalent power and speed.

Ease of servicing has received thorough consideration in the design of this engine. The unusual accessory box formed by the camshaft and its housing has already been mentioned. The pistons can be pulled without dismantling any bearings, connecting rods or piping, simply by unscrewing the four bolts which hold the pivot pins of the rocker arms. Every single part of the engine, except the crankshafts, can be dis-



(Center) Diagram showing de-phasing of pistons.



(Below) Pistons are easily accessible and can be pulled by unscrewing bolts which hold pivot pins of rocker arms.

Major Specifications of ZG7 and ZG9 Engines

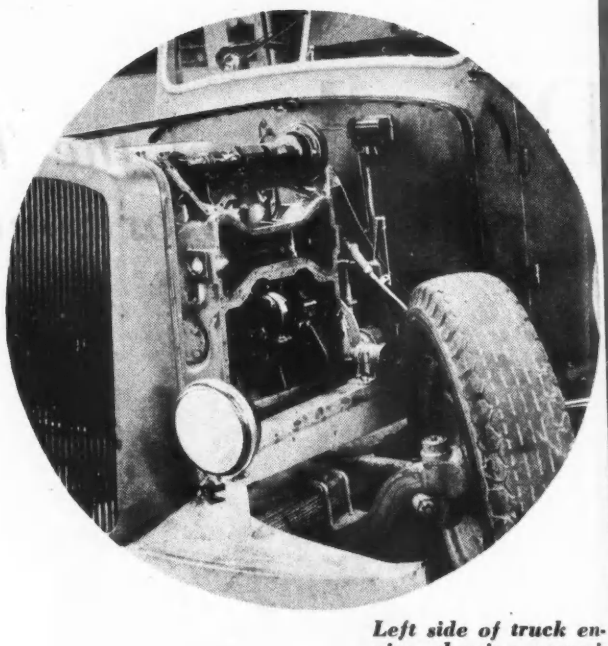
ENGINE TYPE	1ZG7	2ZG7	3ZG7	4ZG7	2ZG9	3ZG9	4ZG9
Number of cylinders	1	2	3	4	2	3	4
Cylinder bore, in.	2¾	2¾	2¾	2¾	3½	3½	3½
Stroke (1 piston), in.	4	4	4	4	4¾	4¾	4¾
Swept volume, cu. in.	47	94	141	188	187	280	374
Bmep, psi	84	84	84	84	84	84	84
Max. combustion pressure, psi	1150	1150	1150	1150	1150	1150	1150
Compression (approx.)	22:1	22:1	22:1	22:1	22:1	22:1	22:1
Normal speed, rpm	1500	1500	1500	1500	1000	1000	1000
Max. speed for automotive use, rpm	1500	1500	1500	1500	1500	1500	1500
Nominal full load rating, bhp:							
at 1500 rpm	15	30	45	60	60	90	120
at 1000 rpm	10	20	30	40	40	60	80
Max. full load rating, bhp:							
at 1500 rpm	17	35	53	70	66	100	135
Normal torque, lb-ft:							
at 1500 rpm	51	103	154	206	206	309	412
at 1250 rpm	51	103	154	206	206	309	412
at 1000 rpm	51	103	154	206	206	309	412
at 750 rpm	49	98	147	199	199	297	397
at 500 rpm	41	82	123	164	164	243	325
Max. torque, lb-ft:							
at 1500 rpm	58	121	180	241	216	325	432
at 1250 rpm	59	123	182	246	230	346	460
at 1000 rpm	58	121	180	241	230	346	460
at 750 rpm	56	115	172	230	220	330	440
at 500 rpm	46	86	142	188	180	271	361
Weight of bare engine, lb.	475	740	.....	.....	2000	2550	3200
Weight of complete automotive type engine without radiator, lb.	750	1000	880	1035	.....	.....	.....

mantled and removed from above. In truck installations, no crawling under chassis and no pitwork are necessary for overhaul.

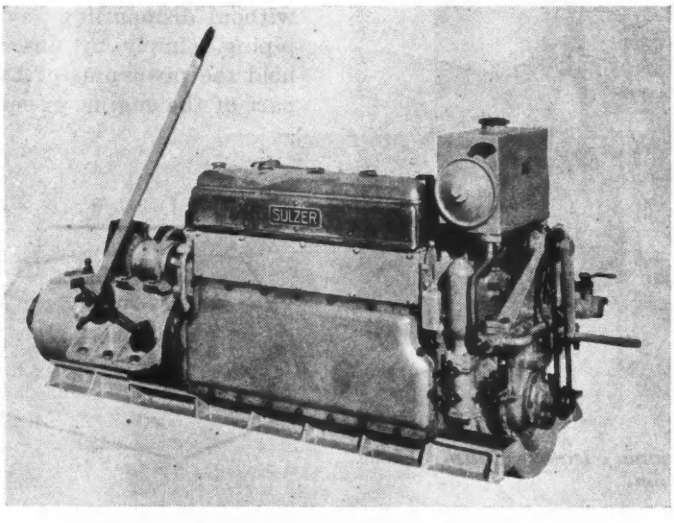
The pistons have crowns of heat-resisting material and are equipped with five compression rings and two oil rings. The top ring, which reaches to the top of the piston, is of unusual design. It consists of an L-shaped inner ring, with a rectangular outer ring filling out the inverted L. Crankshaft and rocker arms are forged steel. The piston pins and the pivot pins for the rocker arms are equipped with needle bearings, while main bearing and crankpin bearings are the shell type.

It may seem obvious that an engine of this type is perfectly balanced and runs smoothly even on light foundations. Actually, the excellent balancing is a result of much engineering. The forces of the opposed pistons do not strictly balance each other; for, to provide supercharging, the inlet ports must remain open for a while after the exhaust ports are closed. Therefore, the pistons on the inlet side, which close these air inlet ports, are made to trail the pistons on the exhaust side. On the other hand, the reciprocating masses are larger on the inlet side than on the exhaust side, due to the scavenging and supercharging compressors driven from the inlet side rocker arms.

The de-phasing of the opposed pistons is a simple matter in this type of engine. It is obtained by locating the crankshaft somewhat lower than the circles described by the rocker arm eyes (see piston de-phasing diagram). With this arrangement, one piston runs forcibly ahead of the other, as its connecting rod comes into a straight line with the corresponding crank before the other one does.



Left side of truck engine showing accessibility of camshaft, fuel equipment, governor and rockers.

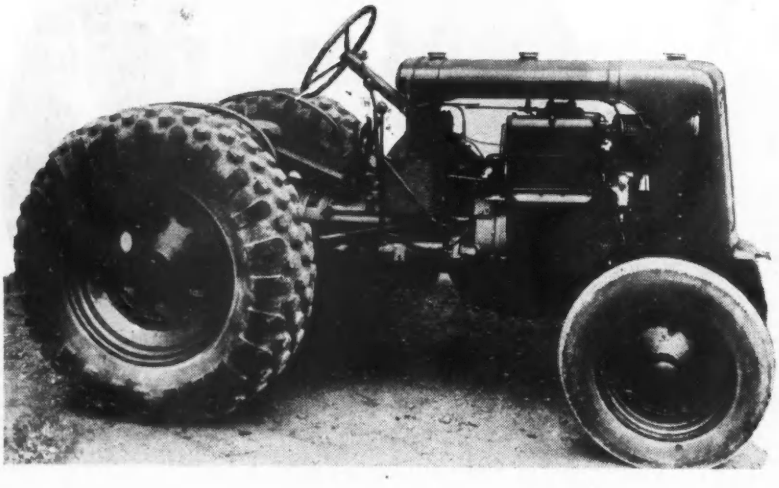


Marine engine 4ZG9 of 120-hp. with cooling and bilge pump, electric starter and reverse reduction gear.

The smallest engine of the series is a one-cylinder 2¾ in. bore unit, having a stroke of four in. for each piston and developing up to 17 hp at 1500 rpm (continuous rating 15 hp). The smoothness of this single cylinder engine is way above that of a one-cylinder four-stroke engine. The latter has one power impulse from one piston every second revolution. This Sulzer engine has two impulses, one from each piston, for each revolution. It thus corresponds to a four-cylinder four-stroke engine having four pistons, four injectors, four fuel pumps and at least eight poppet valves, eight cams and eight push-rods. The simplicity of the new engine is obvious. A two-cylinder version of the same 2¾ in. bore engine, developing up to 35 hp, is made in regular production as a power plant for farm tractors.

A larger engine, with a 3½ in. bore and

(*Turn to page 60, please*)



Tractor equipped with 35-hp. Sulzer engine

What Sweden Did

to Overcome Petroleum Shortages

By Armas Morby

ONE of the severest blows to Sweden at the outbreak of the war was the loss of petroleum imports, especially gasoline and engine lubricants. However, the forests of Sweden have saved the day; without them, the transport systems and industries of wartime Sweden would have had to shut down.

Trying to neutralize the hardships of the situation, Swedish engineers and scientists have worked along two lines—converting equipment from the use of gasoline and mineral oils to charcoal and other solid fuels; and extracting engine fuels from forest timber and the schist-rocks of Mid-Sweden. The mineral oils, stored at the beginning of the war, had to be reserved for military purposes.

Charcoal and Tar-Oils for Engines

As may be well known, charcoal and producer-gas were no novelty in Sweden. Manufacturers had been supplying equipment for utilizing fuels of this kind for many years and had succeeded in mastering the existent difficulties. At the beginning of the war, many private workshops and industries shot up like mushrooms; even Government-owned factories were established. According to the latest figures, there are now in Sweden approximately 70,000 vehicles driven by producer-gas (see Fig. 1). Likewise, the fishing-boats have turned from gasoline to producer-gas or charcoal, and the exhaust gases from the farm-tractors very often smell of charcoal. Even commercial industry has had the benefits of previous research with many stationary producer-gas sets dotting all of Sweden. Industry has also converted some of its machinery to be driven by electricity, coal gas, wood or coal.

The Schist Oil

As long ago as World War I, Sweden had tried to extract oil from the schist rocks but, in the following years, the interest diminished. In 1932, the Naval Technical and Economical Board took over private plants and, at the beginning of World War II, the Governmental Swedish Schist Oil Co. was established. In the last five years, the activity of the company has greatly increased.

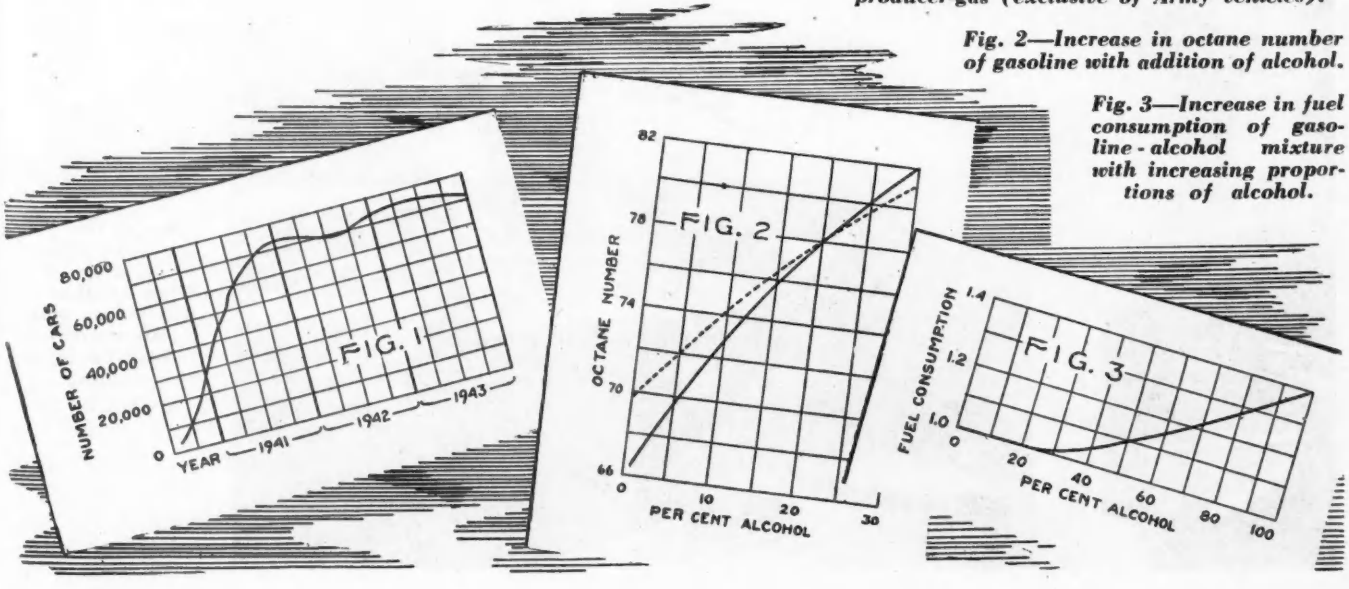
The extraction processes are carried on along two lines—schist is quarried, transported to a crushing-mill and, later on, heated in especially-designed furnaces to "sweat" the oil out of the ore; by the other method, six bores are made in the ground, each one forming a corner of a hexagon. In each bore is placed an electric-heating set which causes the oil content of the rock to rise, as a vapor, up a tube placed in a bore in the center of the hexagon. This oil vapor is then liquefied in a condensation chamber.

(*Turn to page* 67, *please*)

Fig. 1—Number of cars driven by charcoal and producer-gas (exclusive of Army vehicles).

Fig. 2—Increase in octane number of gasoline with addition of alcohol.

Fig. 3—Increase in fuel consumption of gasoline - alcohol mixture with increasing proportions of alcohol.



This is the 107th in the series of monthly production features

Automotive

By Joseph Geschelin

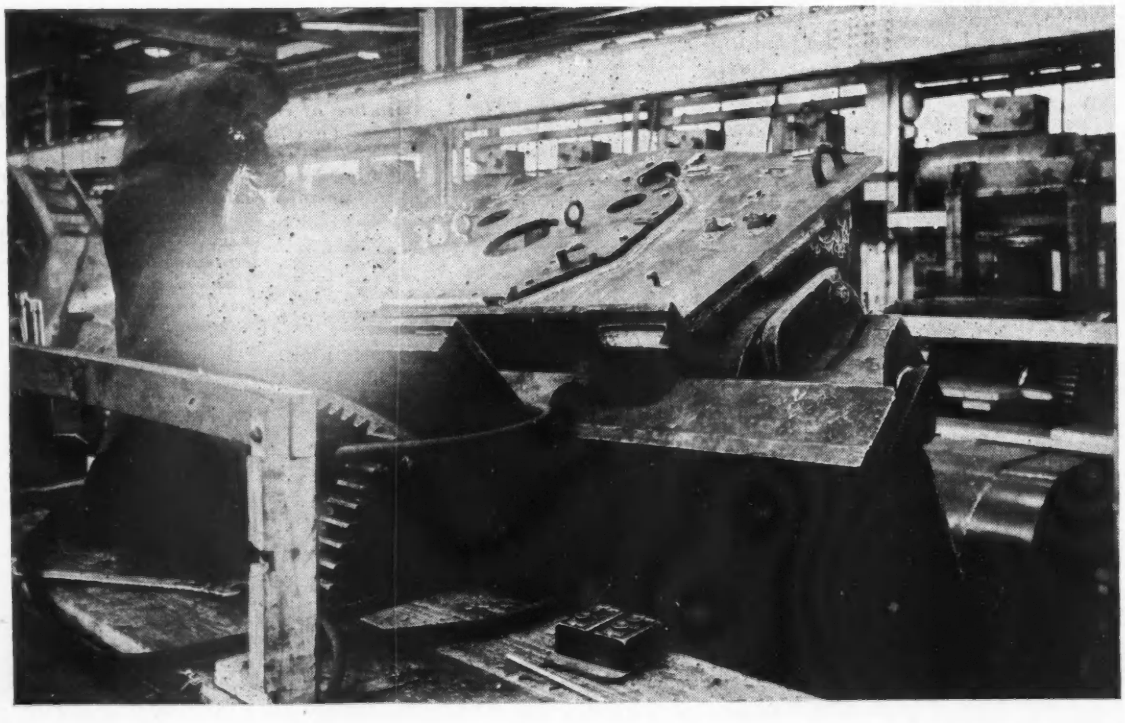
IT'S A far cry from building one of the finest motor cars to producing 20-ton tanks. Yet that has been the wartime task of the Cadillac Motor Car Division. The current product, announced almost a year ago, is the M-24, a fast light tank mounting a 75-mm cannon.

At least two elements of the M-24—the engine and power train—were borrowed from motor car practice and have had the benefit of continuous production during the war. The M-24 is powered with two Cadillac V-8 engines having unit-mounted Hydra-Matic transmissions connecting to a single power transfer unit. The transmission is automatic with eight forward speeds and four in reverse. A manual control is provided for shifting to the upper or lower ranges of forward speed.

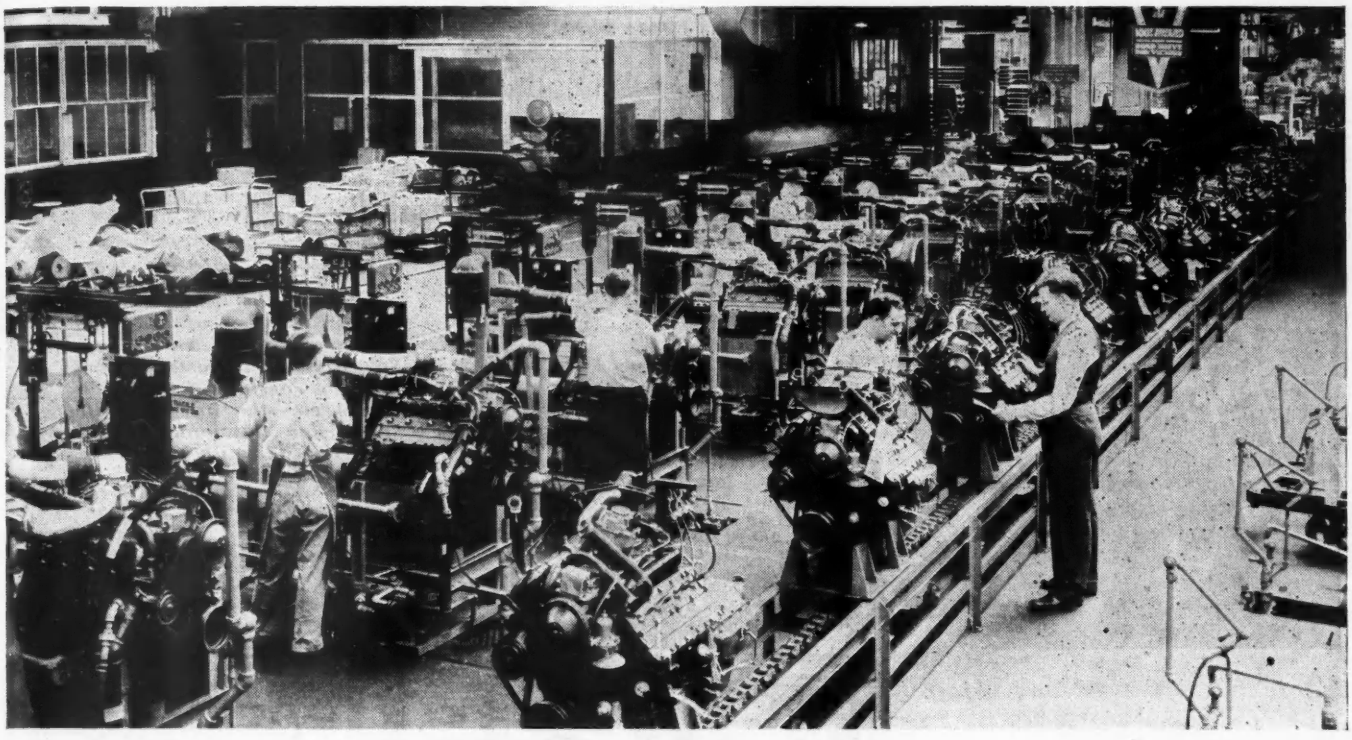
Exceptional features of the M-24 are its maneuverability, "soft" footing on marshy terrain, relatively high speed, and excellent riding comfort both for the crew and the vehicle. These features are inherent in the advanced design of the suspension system which incorporates a wide steel track with low unit ground pressure, an automatic slack adjustment feature for the track, and the use of torsion bars for the track wheel suspension. The M-24 track uses ten track wheels, five to a side, with a torsion bar mounting for each wheel, and with heavy-duty automotive type shock absorbers to take the shock and rebound due to high-speed movements over all manner of terrain and road obstructions.

Except for a few adapting changes, the Cadillac engines are the same as passenger car engines and are built in the same department and with essentially the same methods and equipment. Since Cadillac produc-

Here is part of the large dynamometer test section at Cadillac. In the foreground is the engine conveyor line extending from the final engine assembly. This provides the final inspection before engines are routed to the test stands.

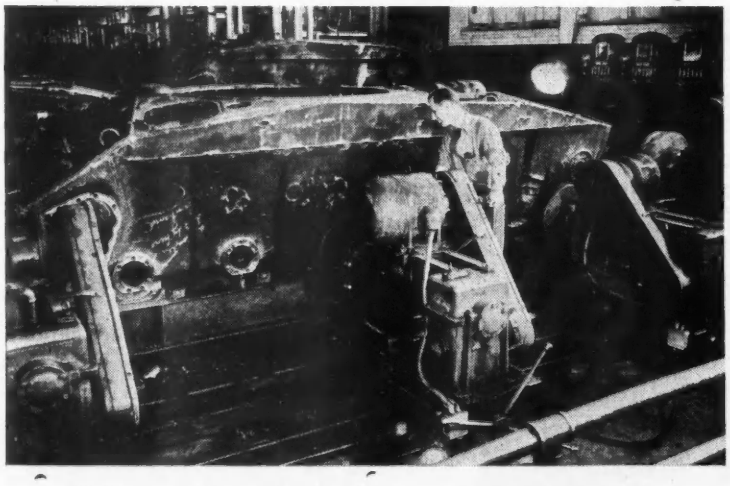


View in the welding bay. Here is a close-up of a huge welding positioner on which a sub-assembly is fabricated by arc welding.



Experience Applied

by Cadillac on M-24 Tanks

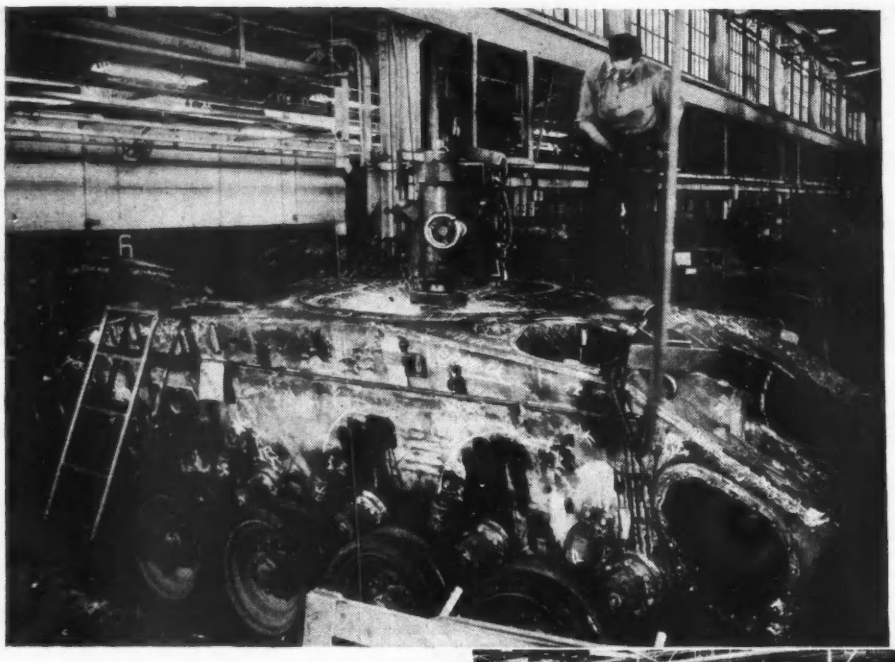


Hull mounting pads for the suspension system and for the final drive are finish-machined in these pit-located machining stations.

tion methods were described quite completely in AUTOMOTIVE AND AVIATION INDUSTRIES some years before the war, no further comment will be made on this phase of operation at this time. Such improvements in design detail and in production methods as may have been made during the war will have an important bearing on the quality and performance of the power plant that will be available to the public when motor car production is resumed.

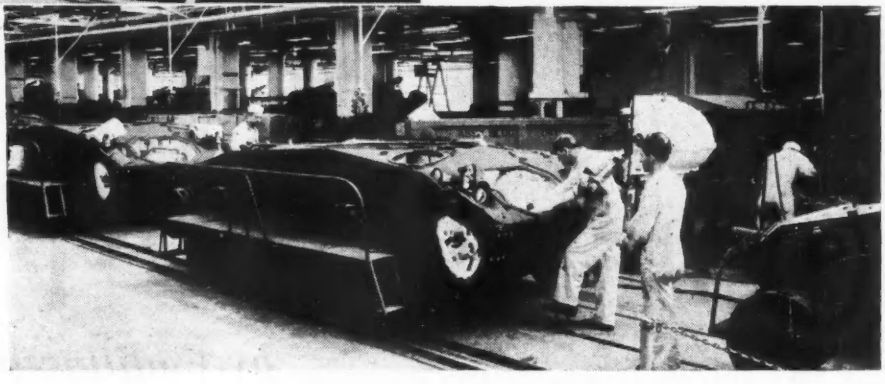
This article is concerned, primarily, with some brief comment on the fabrication of the armor-steel hull. It may be noted that the Cadillac plant, although well suited to motor car manufacture, was not as ideally convertible for the building of tanks. The ideal tank plant is high-ceilinged and spacious to accommodate the relatively large mechanism. However, the job had to be done and the fabrication and assembly operations had to be accommodated to the floor space and ceiling that existed. How well this was done can be best appreciated from the illustrations reproduced here.

Hull assembly operations have been skillfully subdivided to facilitate productivity. One large bay is devoted entirely to the fabrication of various individual sections and sub-assemblies of the hull. Most of the welding is done with the electric arc, the department featuring some 470 motor generator sets of 400-ampere capacity, and of a variety of familiar makes. Welding of the hull is completed on



(Left) A portable grinder is used on the hull line for finish-grinding the bore and upper face of the turret mounting ring.

(Below) A view along the tank assembly line, showing the installation of the final drive. This illustration emphasizes an important detail for the comfort of the fighting crew—the use of white paint for the tank interior and for the finish of interior installed elements.

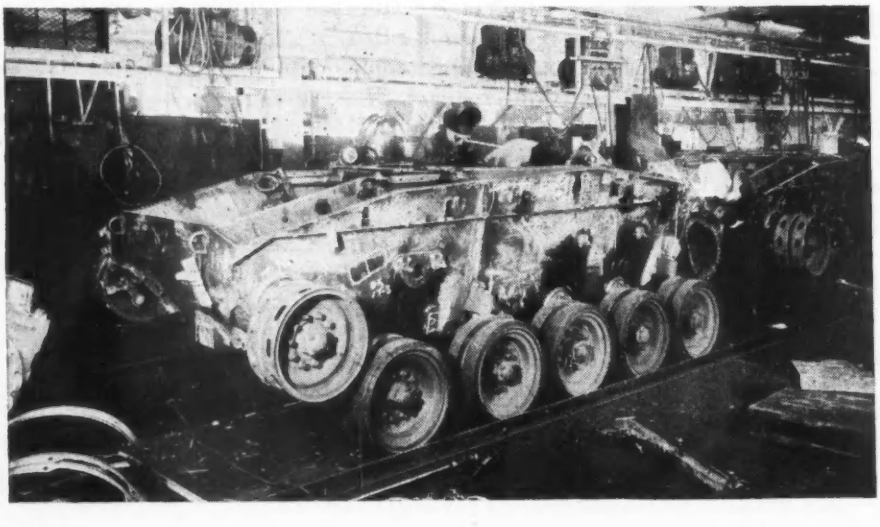


an enormous merry-go-round conveyor line on which the individual hulls move from one station to another until all of the welding operations have been completed, each trained welder doing the same job on each hull.

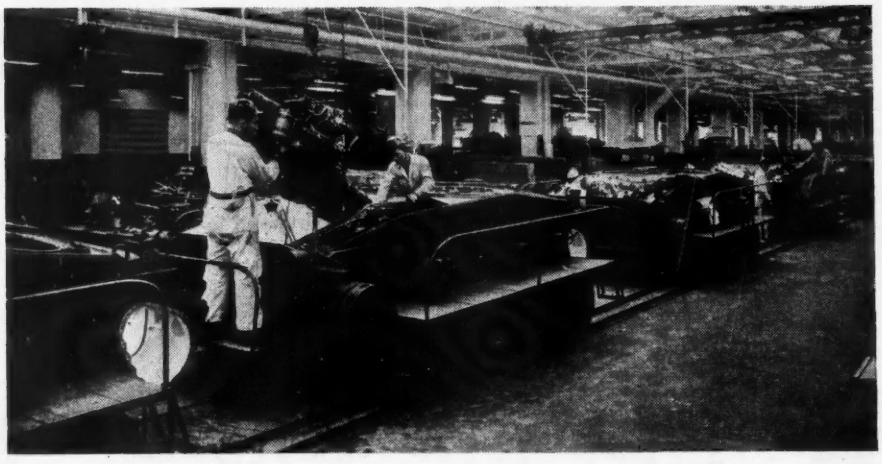
Unique feature of the Cadillac is the pit machine line for the finish machining of the exterior mounting pads for wheel suspension, for the final drive mounting, etc. As illustrated, the hulls are lowered onto the machine bed and the various mounting pads then are milled, bored, and drilled to specified tolerances and alinement. This procedure assures the final correction for the variations and accumulated errors due to the welding of the hull, making for complete and ready interchangeability of major parts at assembly stations.

Following machining, the hulls are transported to the beginning station of the right-angled hull assembly line where the track wheels and idler wheels are installed and where the finishing touches and repairs are made. An interesting phase of the work on this line is the finish machining of the turret mounting ring. As illustrated, the face and bore of the mounting ring are finish-ground by means of a portable vertical grinder. As in the case of the mounting pads, this procedure produces the final alinement of a major element to correct for variations accruing from sub-assembly and welding operations.

The final assembly line is



Hull sub-assembly line in the initial stages. This shows welding operations required to complete details of every description. Some of the welding generators installed in various parts of the welding department may be seen mounted overhead in the background.



This is the engine installation station on the final tank assembly line. Engines are transported by electric hoist from the sub-assembly station at the side.

found in a separate building and is arranged in the form of a U. The first leg of the U is a conveyorized assembly line on which is made the installation of the major and minor units such as the engine, final drive, cooling system turret assembly, track, wiring harness, fuel lines, etc. The other leg is primarily for repairs after road testing and for the installation of accessories and stowage of all kinds.

The final station on the assembly line is the track assembly. At this point, the engines are started and the tank rolls off the line under its own power and is ready for the road test. Upon returning from the road test the tanks go to the repair department for the final touches and repairs, installation of accessories and stowage, final paint, etc., and are ready for delivery to the Army.

Automotive mass-production practice is followed in the operation of the hull and final assembly lines. In each instance, sub-assembly stations are arranged at right angles to the assembly line directly at the installation station. This applies to engines, transfer cases, final drives, cooling systems, tracks, etc. Each of these is prepared completely for installation at the proper time.

Painting is another of the major jobs in the tank department. Hulls are cleaned and spray-painted in booths at the end of the hull assembly line before they are delivered to the final assembly line. One of the interesting spots, reminiscent of motor car techniques, is an extensive closed conveyor line for the painting and protective lacquer spraying of engine parts and other parts such as brackets and sheet metal. All manner of parts are suspended from the heavy duty monorail conveyor and are suitably treated as they pass the various spray booth stations.

Wedge-Drawing Test Investigated in Britain

A CRITICAL and experimental examination of the wedge-drawing test as a possible basis for the commercial testing of sheet and strip material for its deep-drawing properties has been made for the Automobile Research Committee of the Institution of Automobile Engineers at Sheffield University under the direction of Prof. H. W. Swift, and a report on the project was issued recently to affiliated manufacturers and operators.

The wedge drawing test is a possible substitute for the Erichsen cup test, now usually applied to sheet metal to determine its deep-drawing properties. One objection to the Erichsen test (in which a circular blank is cupped in a die) is that a large number of punches are required, one for each gage of metal to be tested. In the wedge-drawing test use is made of specimens with a wedge-shaped or tapering section, which are drawn between wedge plates, and the ratio of the maximum width B of a specimen that can be successfully drawn, to the minimum width A is taken as an index of the deep-drawing capacity. The method was first described by Sachs in 1930, and since then a number of other experimenters have worked with it, chiefly in Germany and the United States. It was found quite early that the results obtained depend to a considerable extent upon the lubricating conditions of the specimen. Thus Sachs found that with aluminum specimens the deep-drawing ratio was 1.85 when tallow was used as lubricant, and 1.61 when rapeseed oil was used.

A special wedge-drawing technique for aluminum was worked out in this country by Brewer and Rockwell. They use a special EP lubricant, sulfurized lard oil with pulverized mica suspended in it, and draw the specimen quite rapidly by means of a hydraulic jack and they claim that with this procedure the effect of friction is negligible.

As regards the more recent work at Sheffield, the purpose was not merely to examine the wedge test as a practical means of measuring drawing properties, but also to obtain information with regard to strains under the conditions of drawing imposed by the test, and the apparatus therefore was built to a larger scale than probably would be required for commercial work. In addition, means were provided for inserting a plate-glass window, so that the progress of straining could be observed or photographed. The best specimen was based on a width of 2 in. at the throat and a total angle of taper of 20 deg. With mild steel of the thickness under investigation (0.036 in.), the breaking load was about 1.5 tons, and this load formed the general basis for the design of the apparatus.

The results of the rather elaborate tests made at Sheffield are rather unfavorable to the wedge-drawing tests, as revealed by the following extracts from the report:

"If friction were only to affect the mean value of the drawing ratio and to a similar extent under different conditions and with different materials, it would not invalidate the wedge-drawing test as a means of comparison between materials, since it would place them in the correct order of merit. But the coefficient of friction varies from one material to another, from one lubricant to another and, as is clear from the tests, even from one test to another under ostensibly similar conditions. It therefore does not allow the wedge test to give a sharp definition between one material and another, nor can it be expected to place materials in their true order; since the range of drawing ratios between different materials is not wide and the effect of friction is large.

"It seems, therefore, that friction is

(*Turn to page* 86, *please*)

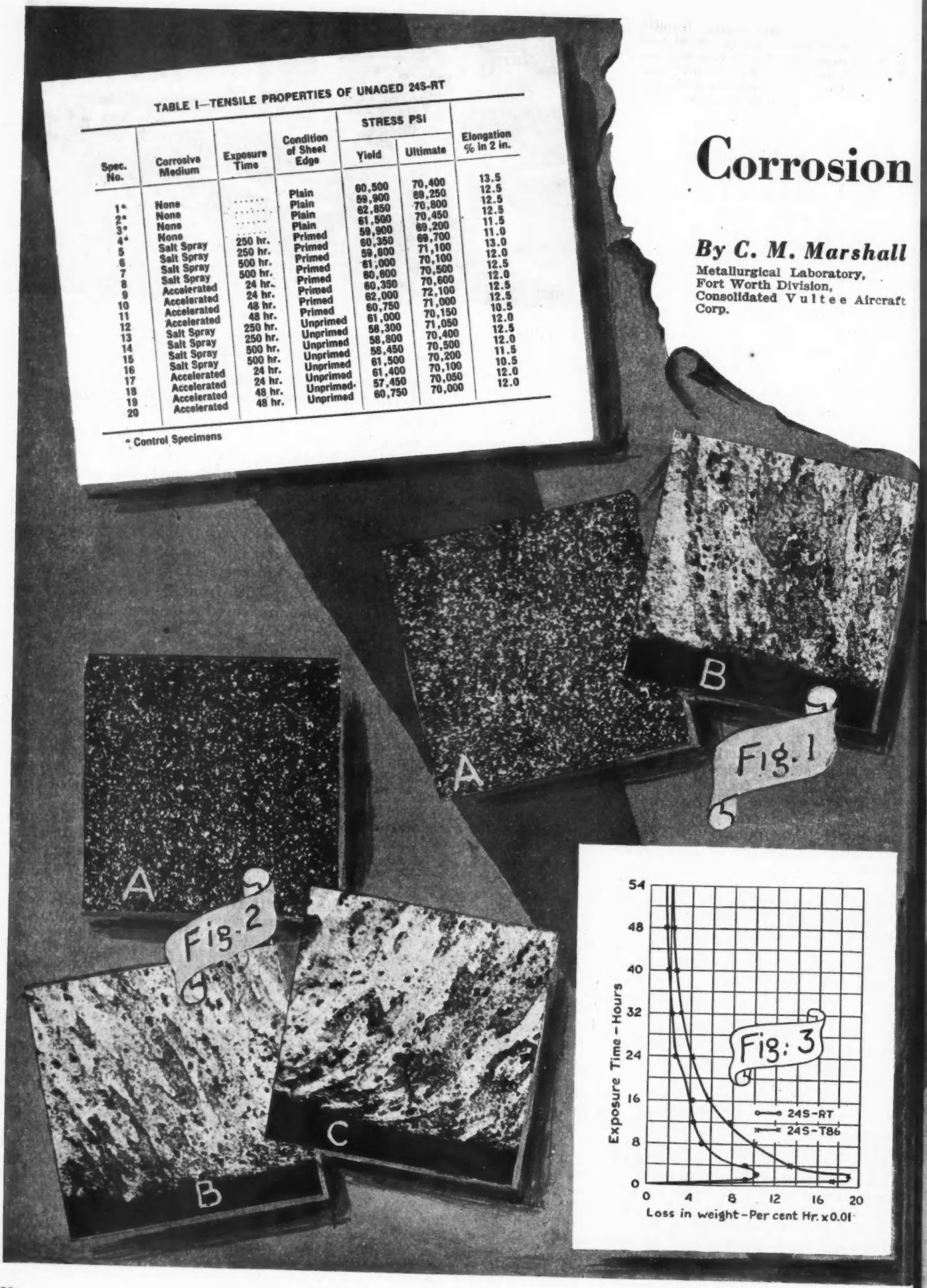
Corrosion

By C. M. Marshall
Metallurgical Laboratory,
Fort Worth Division,
Consolidated Vultee Aircraft Corp.

TABLE I—TENSILE PROPERTIES OF UNAGED 24S-RT

Spec. No.	Corrosive Medium	Exposure Time	Condition of Sheet Edge	STRESS PSI		Elongation % in 2 in.
				Yield	Ultimate	
1*	None	.....	Plain	60,500	70,400	13.5
2*	None	.....	Plain	59,900	69,250	12.5
3*	None	.....	Plain	62,850	70,800	12.5
4*	None	.....	Plain	61,500	70,450	12.5
5	Salt Spray	250 hr.	Primed	59,900	69,200	11.5
6	Salt Spray	250 hr.	Primed	60,350	69,700	11.0
7	Salt Spray	500 hr.	Primed	59,600	71,100	13.0
8	Salt Spray	500 hr.	Primed	61,000	70,100	12.0
9	Accelerated	24 hr.	Primed	60,600	70,500	12.5
10	Accelerated	24 hr.	Primed	60,350	70,600	12.0
11	Accelerated	48 hr.	Primed	62,000	72,100	12.5
12	Accelerated	48 hr.	Primed	60,750	71,000	12.5
13	Salt Spray	250 hr.	Unprimed	61,000	70,150	10.5
14	Salt Spray	250 hr.	Unprimed	58,300	71,050	12.0
15	Salt Spray	500 hr.	Unprimed	58,800	70,400	12.5
16	Salt Spray	500 hr.	Unprimed	58,450	70,500	12.0
17	Accelerated	24 hr.	Unprimed	61,500	70,200	11.5
18	Accelerated	24 hr.	Unprimed	61,400	70,100	10.5
19	Accelerated	48 hr.	Unprimed	57,450	70,050	12.0
20	Accelerated	48 hr.	Unprimed	60,750	70,000	12.0

* Control Specimens



Resistance of Clad 24S Aluminum Alloys

THE results of tests during which clad 24S, both aged and unaged, was exposed to a salt spray solution for 500 hours and to an accelerated corrosion media containing salt and H_2O_2 for a 48-hour period indicate that the yield and ultimate strengths of both types were not affected by either of the corrosive solutions. The elongation of both materials was reduced approximately 2 per cent by the above exposure but remained above applicable specifications.

Fig. 1 — Photomicrographs of clad 24S-RT — Control specimens

A—Clad surface (500X)
B—Cross section at sheared edge of sheet (200X)

Fig. 2—Photomicrographs of clad 24S-RT—48 hr. accelerated corrosion

A—Clad surface, showing small corrosion pits. (500X)
B—Cross section at sheared edge of primed sheet. (200X)
C—Cross section at sheared edge of unprimed sheet. (200X)

Fig. 3—Percentage weight loss* per unit time

*(By immersion in accelerated corrosion media)

Surface pits were noticeable on both clad 24S-RT and 24S-T86 after 500 hours exposure to salt spray. This pitting was slightly greater in clad 24S-T86. Microscopic examination revealed the presence of slight corrosion along the grain boundaries at the edges of unprimed clad 24S-T86 after exposure for 48 hours to the accelerated corrosion media. This corrosion occurred to a depth of not more than .005 in. from the edge of the sheet. No intergranular corrosion was visible in clad 24S-RT or primed clad 24S-T86 after the above exposure tests. No intergranular corrosion was visible in either 24S-RT and 24S-T86 (clad type) after 24 hours exposure to the accelerated corrosion media. Since intergranular corrosion only occurs to a depth of .005 in. in unprimed clad 24S-T86 after 48 hours exposure to the accelerated corrosion media, and since the decrease in elongation caused by this exposure is not greater than that occurring in clad 24S-RT, it is not considered necessary to prime the edges of aged material.

Further tests to show more accurately the rate and extent of corrosion on protected and unprotected 24S-RT and 24S-T86 when exposed to the accelerated corrosive media produced the results shown in Tables I and II and Fig. 3 with the further conclusion that priming completely prevented corrosion in both types of material.

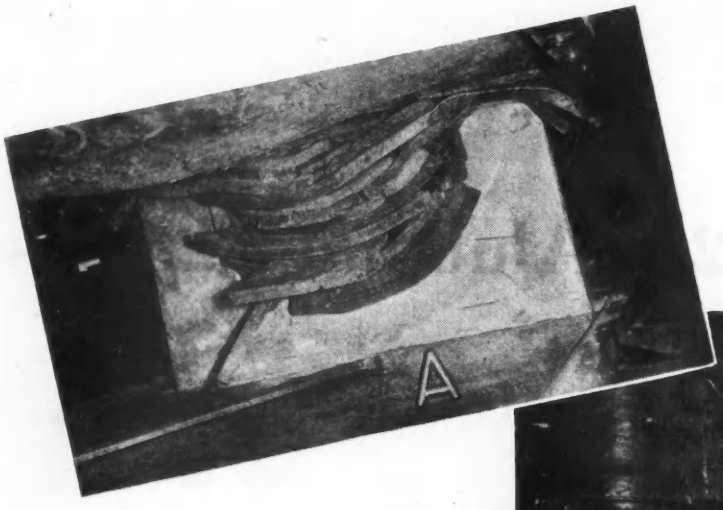
The prime coat used in all these tests consisted of a zinc chromate base. The salt spray was a 20 per cent salt solution (NaCl) at 95 degrees F, while the accelerated corrosion media was a solution containing 220 grams of NaCl, 400 ml. of 3 per cent H_2O_2 and 3600 ml. of distilled water at room temperature with exposure to air for one-hour periods following each one-hour dipping in the solution. Figs. 1 and 2 show the photomicrographs of the clad surface and cross section of the edge before and after exposure for 48 hours to the accelerated corrosion media.

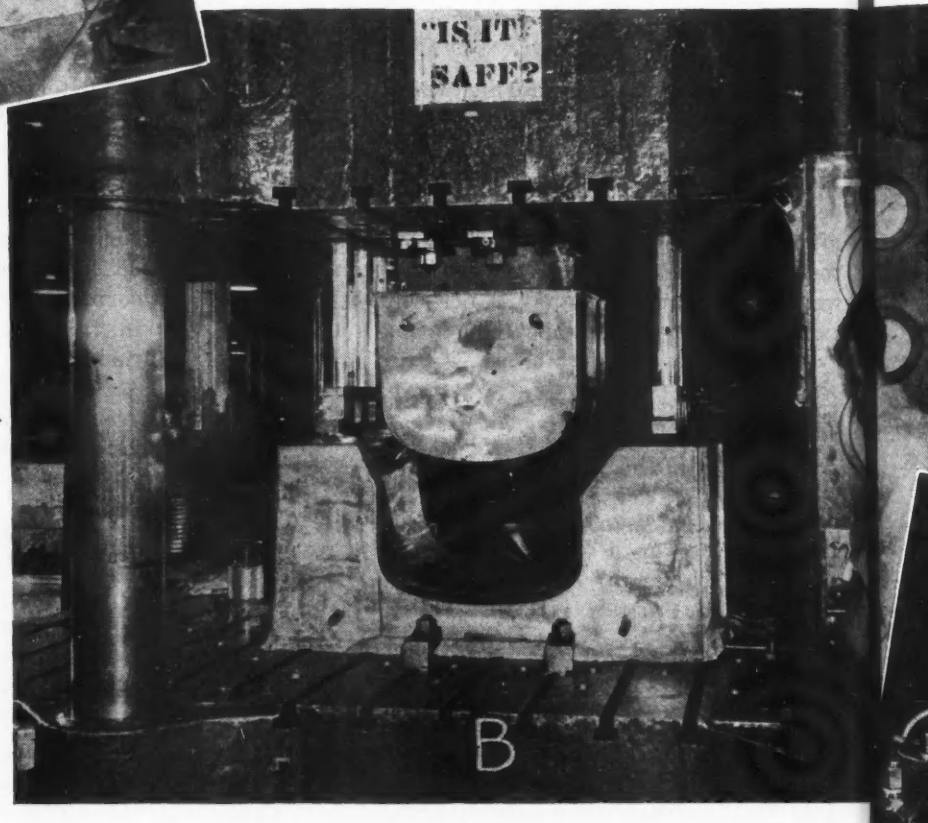
TABLE II—TENSILE PROPERTIES OF AGED 24S-T86

Spec. No.	Corrosive Medium	Exposure Time	Condition of Sheet Edge	STRESS PSI		Elongation % in 2 in.
				Yield	Ultimate	
1*	None	.....	Plain	69,200	72,800	5.5
2*	None	.....	Plain	69,700	73,700	5.5
3*	None	.....	Plain	69,800	73,300	6.0
4*	None	.....	Plain	68,800	74,900	6.0
5	Salt Spray	250 hr.	Primed	69,250	72,600	5.0
6	Salt Spray	250 hr.	Primed	69,950	73,500	5.0
7	Salt Spray	500 hr.	Primed	70,200	73,750	5.0
8	Salt Spray	500 hr.	Primed	69,000	74,000	5.0
9	Accelerated	24 hr.	Primed	69,400	72,500	5.0
10	Accelerated	24 hr.	Primed	71,000	74,600	5.0
11	Accelerated	48 hr.	Primed	71,150	74,500	5.0
12	Accelerated	48 hr.	Primed	71,100	74,150	5.0
13	Salt Spray	250 hr.	Unprimed	70,600	74,000	4.5
14	Salt Spray	250 hr.	Unprimed	70,200	73,500	5.0
15	Salt Spray	500 hr.	Unprimed	69,800	72,750	4.0
16	Salt Spray	500 hr.	Unprimed	70,400	73,400	5.0
17	Accelerated	24 hr.	Unprimed	69,500	73,100	4.5
18	Accelerated	24 hr.	Unprimed	70,700	73,550	5.0
19	Accelerated	48 hr.	Unprimed	70,180	73,700	4.5
20	Accelerated	48 hr.	Unprimed	69,250	73,400	4.0
						4.5

* Control Specimens

Side Lights o





By A. H. Petersen
Chairman, Los Angeles Chapter No. 5, American Society of Industrial Engineers

PRODUCTION engineering whether administered by Production, Methods, Time Study, Standards or Tool Engineers has a single objective; namely, to increase the rate and lower the cost of production. It has been said, "When a unit of experience is put into a design, an equal amount of material or weight can be taken out." A saving of a unit of time, of fatigue and of cost might well be added as beneficial results. Each phase in the initiation of a design and getting it into production must be clearly delineated, from experimental design through production design, including equipment requirements, production flow, scheduling, tool design, checking, proving, time and motion study, standardization, cost reduction and, finally, correction.

Buckingham has stated, "The work of machine design involves two distinct tasks: First, the functional design; and, second, the production design." This means that a product first engineered to perform a particular function is never the end-product available for customer consumption since it is not possible to inject into the original design all of the "hind sight" that develops while processing the product through the various stages of its manufacture.

It follows then that it is essential that Production Engineers be assigned to Engineering Departments to work on approved designs from the standpoint of their reproducibility by economical available methods, and further, that they have the authority to retain this responsibility until the product is in its final form, passing on all shop problems caused by the design, if the ultimate in production efficiency is to be attained. The organization must then be so arranged that the proper channels of information on items affecting production can flow both to and from all affected departments, including engineering.

In one plant, a gun mount was subcontracted as a complete item. The tolerances on the mating parts were less than the coefficient of expansion of the materials during a temperature rise of 50 F, so the company making the parts changed the dimensions to produce satisfactory assemblies. After a period of months, the contract was relet to another company. Since the latter worked to the original drawings and not to the changes made by the first subcontractor, production was halted for a considerable length of time to establish tolerances within the second subcontractor's production limits. After a period of approximately three months, the drawings were finally changed and satisfactory parts again received. During this investigation, it was found that the first subcontractor had endeavored to obtain relief from the design and inspection branches of the prime contractor but had finally given up in despair. In all of these months, the responsible production engineer of the prime contractor had not been made acquainted with the problem.

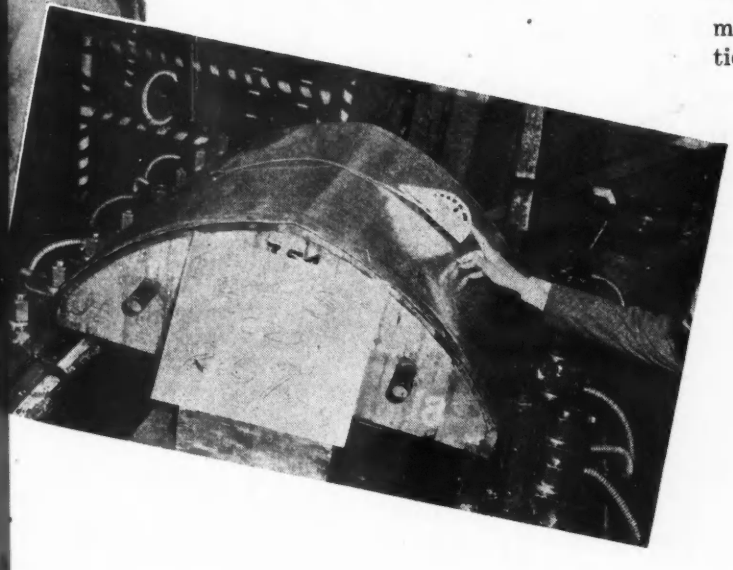
This war has once more demonstrated the accuracy

s of Production Engineering

A — Experimental stamping method using rubber stacking on hydro-press die.

B—Production setup with special type of stretch die for coolant radiator cover.

C — Production method similar to other stretch setup shown here. Scrap for gripper jaws a factor that must be considered in adopting stretch method.



of the old formula, Manpower plus Machines plus Materials plus Methods equals Production. When the war started and the production capacity of the country was investigated, the total units of manpower and machines and material available were found not to be sufficient to meet the requirements established by the War Production Board. A survey of all facilities indicated that only by one means could production be increased; namely, by "Methods," and then only by proper use of these methods.

Proper Application of Methods Important

The word "methods" covers a huge field, and those responsible for proper application of these methods may be either specialists or men of wide and varied experience. Many of the present so-called production men are of the "one method" variety. Their ideas are either channeled so that designs come out as all weldments, all castings, all sheet metal, or, through a lack of knowledge, they are prone to apply methods still in the development stage to the production lines. The net result is that the proper method is not used or the shop is inflicted with the necessity of developing a method along with the product.

For example, a stainless steel tube about one in. in diameter and nine ft long required a plug, three ft from one end, which had to resist considerable pressure without leakage. It was decided to silver braze this plug into place by slipping a ring of brazing material into the tube followed by a plus and another ring of brazing material, all carefully fluxed and then joined by induction heating.

There is nothing wrong with this method if equipment, tools and experience are available. In this particular case, a considerable amount of development and testing was required (at a time when the product was urgently needed) before the necessary approvals could be obtained, whereas, the usual practice of this particular plant would have been to use two tubes with the plug located in place at the end of one of them and the three joined by a peripheral arcweld.

The Production Design Must Evolve

In many industries, there is no production design except that which evolves as the operations are planned and the tools designed. With this sort of setup, it is customary that all changes be aproved by the design authority, who, since he is now working on a new phase of the design, is opposed to any changes and is likely to assume that they are requested with ulterior motives. In so doing, he fails to realize that the only true test of the practicability of a design is in its actual production under mass production conditions and that a design which is adequate for smaller lots may not be so in production.

This lack of foresight in the transition from small to mass production is illustrated in the following: A small adjusting plug for a control was designed with a thread pitch of 12½. The first lot of parts was made by hand on an engine lathe with a special screw and gear. When the part was planned for production on the turret lathe, it was discovered that no screws or change gears were available for such a pitch. The design authority refused to change the drawing to 12 pitch (which, incidentally, would not have affected proper function of the part) with the statement that since the parts had been made once, he saw no good reason why they could not be made again.

(*Turn to page* 92, *please*)

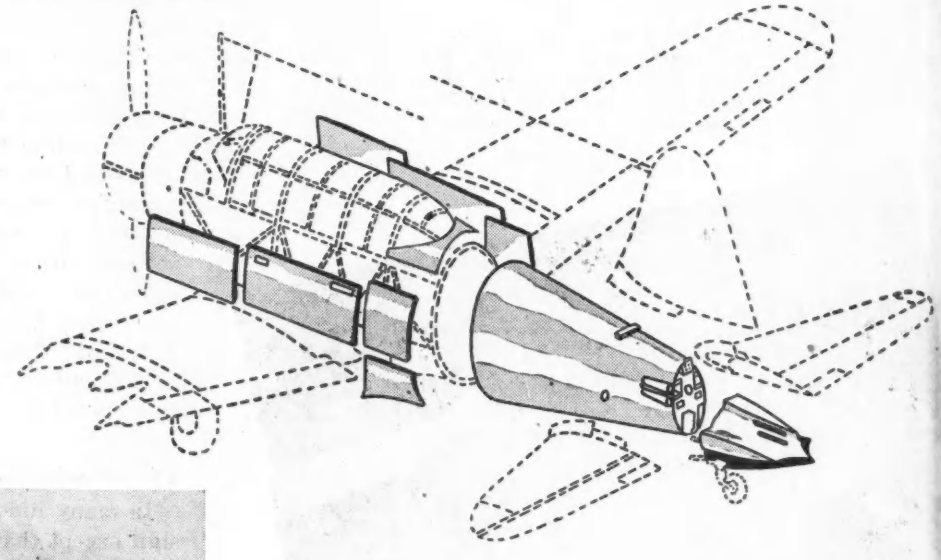
Glass-Plastic

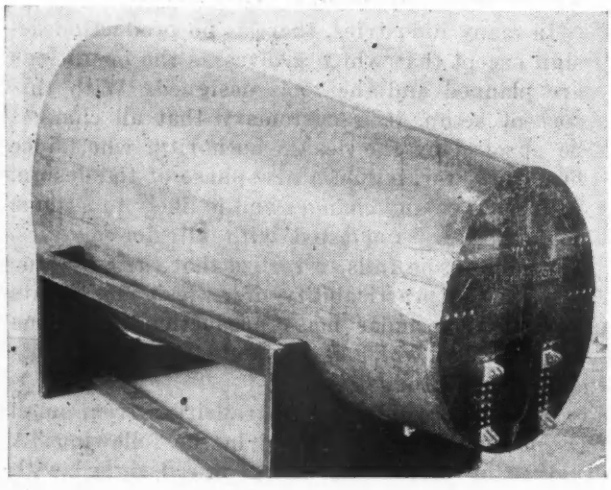
By Capt. George B. Rheinfrank, Jr. and Capt. Wayne A. Norman
Air Technical Service Command
Army Air Forces, Wright Field

(Above) Block of honeycomb glass core and slices of the new aircraft material.

(Right) Location of plastic-type sandwich structures on a BT-15 trainer.

(Below) Fuselage section of glass - plastic construction. Note how fittings are attached at rear.





A NEW resin impregnated glass-cloth is being used at Wright Field for fabricating trial fuselage sections and wing panels—permitting simplified construction methods, built-in sound-proofing and smooth exterior finishes that may result in improved aerodynamic performance for aircraft. Ultimate aim is the all-glass airplane which can be molded like a flower vase, eliminating thousands of rivets and criss-crossing metal structural members while at the same time having the strength-weight characteristics and endurance of an all-metal aircraft. The new glass-plastic has these potentials according to recent tests.

Already a laminated material consisting of a balsa wood core sandwiched between layers of glass-cloth has been molded into a BT-15 rear fuselage section and test flown with favorable results. And a similar fuselage section built entirely of glass construction has been strength tested and proved to possess strength-weight characteristics 50 per cent greater than aluminum construction and 80 per cent greater than wood. The latter glass material has a honeycomb glass-cloth, plastic core and has durability greater than the balsa-glass combination. Likewise molded wing panels are being constructed of the new glass laminate and tests will soon be carried out with airplanes having glass fuselages and wings.

Although use of impregnated plastics for aircraft parts, such as doors, fairings, radar domes and miscellaneous interior fittings is not new—fabricating basic structures heretofore was impractical until a

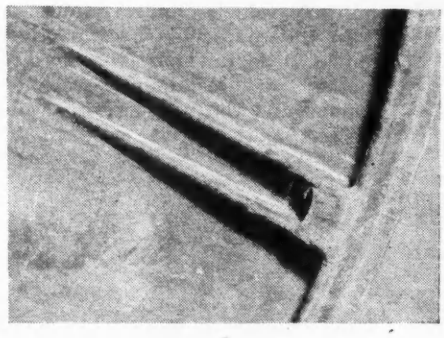
with Honeycomb Core

New Structural Material for Aircraft

stronger plastic laminate was made available. Many different types of fibers—cotton, linen, rayon, silk—were tried, but glass proved the most satisfactory. It possesses a high impact resistance, low moisture absorption, a strength-weight ratio that is greater than all the other fibers and can be produced in continuous filaments whose physical properties are closely controlled, making possible a strong uniform structural material. The glass fibers are now used as reinforcing agents in a new type copolymer resin which eliminates high pressure and high temperature baking processes for molding the laminate to various shapes.

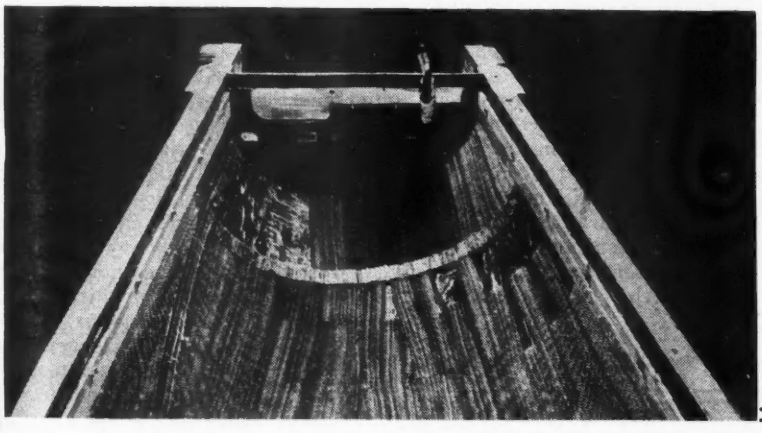
Sandwich type construction was selected because it possessed an inherent rigidity that permits elimination of internal stiffening structure, such as stringers and bulkheads. In addition, the entire glass-sandwich can be fabricated in one operation since the new resin for bonding can simultaneously laminate the glass fibers and glue them to the core material. The use of these new low-pressure resins in conjunction with glass fibers—which develop their maximum strength in an uncompressed condition — enables a fabricator to mold structures using no more pressure than is necessary to hold the fibers in place during curing or baking process. Molded parts can now be made by simply placing them in an oven and baking them under vacuum pressure. The whole process is as simple as baking a loaf of bread. For example, the all-glass BT-15 fuselage section was constructed in these various steps:

1. Several layers of glass-fiber cloth, each coated with laminating resin were placed in an aluminum mold—the shape of half the full monocoque fuselage section—to form the outer face of the plastic sandwich. (*Turn to page* 58, *please*)



(Right) Closeup of a molded fitting.

(Below) Honeycomb glass core partially placed on outer skin of fuselage.



Comparative Specific Strengths of Cross-Laminated Glass Cloth and Aluminum

Property	*1 Typical glass-cloth laminate*[a]	*2 Specific strengths glass-cloth lam.*[b]	*3 Specific strengths 24ST aluminum*[b]	*4 Aluminum alloy 24ST sheet*[c]	*5 Specific value*
Specific gravity, s.g.	1.75	1.75	2.77	2.77	.....
Ultimate tensile strength, u.t.s.	47,400 p.s.i.	27,000	22,400	62,000 p.s.i.	$\frac{\text{u.t.s.}}{\text{s.g.}}$
Ultimate compressive strength, u.c.s.	45,000 p.s.i.	25,700	22,400	62,000 p.s.i.	$\frac{\text{u.c.s.}}{\text{s.g.}}$
Modulus of rupture, u.f.s.	65,400 p.s.i.	21,400	8100	62,000 p.s.i.	$\frac{\text{u.f.s.}}{(\text{s.g.})^2}$
Modulus of elasticity (buckling) $E \times 10^6$	2.2 p.s.i.	0.41	0.495	10.5 p.s.i.	$\frac{E}{(\text{s.g.})^3}$
Modulus of elasticity (deflection) $E \times 10^6$	2.2 p.s.i.	1.25	3.8	10.5 p.s.i.	$\frac{E}{(\text{s.g.})}$

[a] Average values of Owens-Corning Fiberglas Corp. Report No. 328 for cross-laminated OC-64 cloth with several types of resin.
[b] Specific values computed as shown in Column 5. Items 4 and 5 take into consideration the increased thickness allowable for equal weight sections of lower density material.
[c] ANC-5.

Recent Developments in

Brake

By P. M. Heldt

IT IS generally expected that there will be many technical innovations in postwar automobiles and commercial vehicles, partly because such a long time will have elapsed since the last prewar models were brought out, and partly because there has been intense scientific and technical research in connection with the war effort, from which automobile engineering should derive at least some benefit. Most of the innovations to come probably will not appear in the first passenger car models to be marketed after the cessation of hostilities, for it is generally agreed that these will be similar to the 1942 models, of which relatively few were produced. But the cars that will be offered during the second postwar selling season undoubtedly will incorporate many of them.

Indications regarding the lines that postwar automobile development is likely to follow have become apparent first in connection with brake engineering. The manufacture of brakes and brake actuating mechanisms has become largely a specialized industry. There are signs that a number of new firms will enter this field when hostilities cease, so that competition is likely to be keener than it has been. However, those who have long been engaged in this branch of the industry have not been resting on their laurels, but have developed new designs that offer advantages with respect to production, operation, and service. One reason why signs of postwar tendencies should have become apparent first in connection with brakes probably is that brake development really never ceased throughout the war period, for efficient brakes are very much needed for both military vehicles and airplanes.

In the course of the war, the Ordnance Department felt a need for a method of reclaiming worn brake drums, and the problem of developing such a method was assigned to the SAE Ordnance Vehicle Maintenance Committee, which referred it to its Special Brake Drum Group. This Group worked out a process which is said to have been found satisfactory by the Department, and to have been adopted by it. A manufacturer of brake linings now is carrying on some experimental work with the idea of making use of this process in the production of new, composite brake drums that would be lighter and have a longer life than present drums. In the reclaiming process the old drum is first bored out to such a diameter that taper and score marks are remove Then a 16-pitch thread is cut in t brake track, and the threads are d torted or bent over with knurling similar tools, with the idea of produ ing a surface layer whose particles w interlock with a lining that is spray on. Previous to the spraying operati the drum is preheated to about 375 during the operation the drum is bei rotated, and spraying is continu until the inside diameter about 0.030 in. less than fi ish size. After the dru has cooled, it is ground o to finish size. Brake drum reclaimed by this process a said to have a longer servi life than new drums in some case

Up to a decade ago most brak drums were steel pressings, which ha the advantages of being light an cheap to produce, but were open to t objection that in severe service the scored easily. Since that time comp site brake drums with a pressed-ste backing or structural member, and cast iron brake track have been large adopted for passenger cars, and pla cast iron drums for heavy commerci vehicles. Cast iron does not score ea ily, but in severe service it develop heat checks. This is due to the fa that in such service heat is generate so rapidly that a steep temperatu gradient is set up in the brake trac the metal near the surface gettin much hotter than that some distan below, which results in such seve stresses that cracks form in the met surface. Another objection to the pla cast iron drum as used for commerci vehicles is that it is rather heavy, an this objection is the more serious b cause the brake drum represents u sprung weight.

The new composite drums referre to, therefore, were made of hea treated aluminum alloy, and the brak track was lined with manganese ste having a 0.800 per cent carbon conten this material being applied by spra ing. Brake drums of this design, 14 by 4 in. in size, have been fitted t small buses of different makes, equippe with air brakes. They reduced th drum weight to about one-third tha with cast iron drums, and they are sai to have the further advantage tha they eliminate brake squeal.

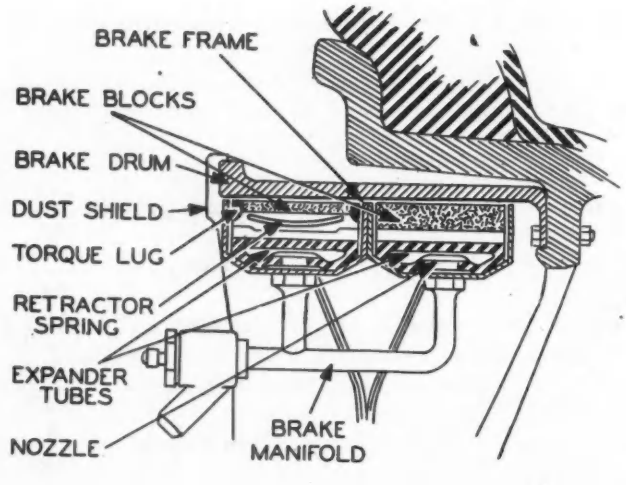


Fig. 1—Sectional view of expander-tube brake.

Part One

Mechanisms

In some experiments with clutch pressure plates of beryllium-copper it was found that this material is very resistant to high temperatures, developing no heat checks in severe operation. This suggested the use of that material for sprayed-on brake tracks of composite brake drums. Experiments along this line, with beryllium-copper sprayed on either an aluminum or a cast iron base, are now being conducted by the Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc.

The first attempts did not give satisfactory results, as the aluminum was heat-treated before the spraying operation, and in heat treating the copper-beryllium it was necessary to limit the temperature, with the result that the apparent Brinell hardness obtainable was limited to 87-95. It is now planned to heat-treat both materials together, after the brake track has been sprayed on. Both are said to be subject to precipitation hardening during relatively long periods of heating. This is expected to result in a higher surface hardness of the copper-beryllium, which should eliminate the scoring or surface smearing experienced in the first attempt. An encouraging result of the experiments thus far has been that there has never been a sign of failure of the bond between the base and the sprayed metal.

For airplanes a type of brake has come into wide use in which friction bars or shoes carried by a brake frame mounted on the landing-gear are "expanded" into contact with the brake drum by forcing brake fluid into a rubber tube reinforced with fabric. It will be remembered that a similar brake was developed for use on motor vehicles about a decade ago, but apparently did not gain a foothold in that field. For aircraft applications this type of brake was developed by Palmer in England and by the B. F. Goodrich Co. in this country. An outline of the development work done by the Goodrich company was given in a paper by B. F. Schippel and R. J. Keller, recently read before the Metropolitan Section of the SAE. Sectional sketches of the brake are shown in Fig. 1. The brake comprises a brake frame secured to the landing gear, with an annular recess extending around its circumference, in which is lodged the rubber expander tube. The tube supports a continuous series of curved blocks of friction material. At its ends each block is reduced in section, and the reduced portions are located in slots in the flanges of the brake frame, the teeth or lugs separating these slots forming torque members. The segmental brake blocks, by the way, form a complete hollow cylinder, so that all of the interior surface of the drum is contacted by friction material. When the pressure in the expander tube is released, the brake segments are withdrawn from the drum by retractor springs of bar form, which extend through the brake blocks and through holes in the flanges of the brake frame.

In their paper, Messrs. Schippel and Keller stated that this type of brake, after extensive tests on a brake dynamometer, as well as service tests on DC-3 planes of United Air Lines, was ordered by this firm for replacement on its entire fleet of DC-3s in service within the United States.

As compared with the ordinary shoe brake, the expander tube brake has a number of interesting characteristics. It is obvious, for instance, that the pressure of application is uniform over the entire friction surface, with the result that all of the brake blocks wear uniformly, and that the pressure of application is completely taken up within the drum, so that brake application imposes no load on the wheel bearings. In this brake, also, there is absolutely no self-energization or de-energization of any sort, because the pressure of application is radially outward, and as the frictional force at any point of the circumference is perpendicular to the applying force, it has no component which works either with or against the force of application.

Manufacture of expander tube brakes in the United States has been taken up by Hayes Industries, Inc., which concern is licensed under the Palmer-Goodrich patents. In early experimental work, carried out by Goodrich, the brake frames were made of aluminum or magnesium alloy, but Hayes now makes them of pressed steel. The expander tubes, of course, are made by the B. F. Goodrich Co. Advantages claimed for expander-tube brakes are that they are simple in design, ensure uniform application of the friction members to the drum, and consequent uniform wear; are light, smooth in operation, and easy to service, and their maintenance cost is low.

The principle of self-energization (and de-energization) plays an important role in modern brake engineering, and will therefore be discussed here in some detail. In a conventional shoe brake, as shown diagrammatically in Fig. 2, the two shoes are anchored at

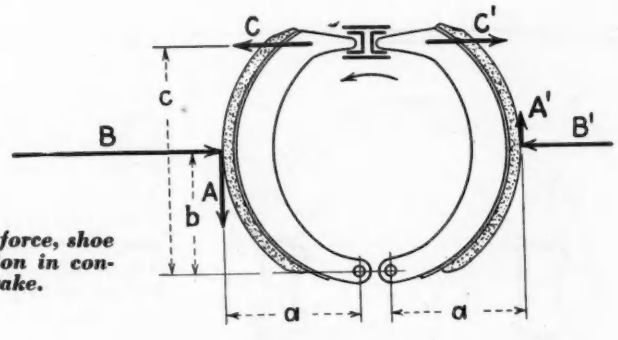


Fig. 2—Actuating force, shoe pressure and friction in conventional brake.

their "heels" to either a single anchor pin or two adjacent anchor pins, and "expanded" at their toes by either a wheel cylinder or a cam. Referring to the diagram, we will assume that the drum rotates left-handedly, as indicated by the arrow, and that the friction coefficient between drum and lining is 0.35. The reaction of the drum against the left-hand (the self-energized) shoe is represented by arrow B, and the friction between these parts by A, which is equal to 0.35 B. The shoe is applied to the drum by a force C exerted by the wheel cylinder. All three forces create moments around the anchor pin—A and C left-hand moments, and B a right-hand moment. For the condition of equilibrium the moments vanish, hence

$$Aa + Cc = Bb,$$

from which equation we can find the value of C for any assumed value of A, as the lengths of the moment arms can be scaled off on the drawing.

The forces on the right-hand shoe are represented by A', B' *and* C'. If the wheel cylinder is of the straight-bore type, C' is equal to C. In this case the frictional force A', instead of creating a moment of the same hand as the force of application C, creates a moment of opposite hand. It, therefore, opposes the applying force, and makes it less effective. As a result, both the pressure B' between drum and brake shoe and the frictional force A' at

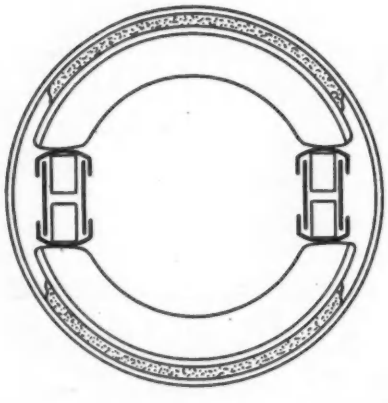


Fig. 3—Diagram of "balanced" brake.

their contact surface are smaller. A' and B' create left-hand moments around the anchor pin, while C' creates a right-hand moment. Left and right-hand moments cancel out, hence

$$A'a + B'b = C'c.$$

Neither A' nor B' is known, but we know that $A' = 0.35\ B'$, and making this substitution we get

$$0.35\ B'a + B'b = C'c,$$

from which it follows that

$$B' = \frac{C'c}{0.35\ a + b}$$

In Fig. 2 the forces are laid off to scale, and it will be seen that with a friction coefficient of 0.35 and moment arms a, b, c of the relative lengths shown, the frictional force A' of the "de-energized" shoe is slightly less than one-half that of the self-energized shoe. In other words, the "de-energized" shoe does only half as much work.

The self-energizing action of the brake thus described has three principal effects. Under the pressure of brake application the drum always distorts. If both shoes were pressed outward with the same force, the drum would assume an elliptic shape, but when one shoe presses harder than the other the drum distorts unsymmetrically. Also, as one shoe presses against the drum with greater force than the other, the pressure of application cannot be wholly taken up within the drum, and some of it is transmitted by the drum to the adjacent axle or wheel bearing, where it adds to the load normally on that bearing. Finally, as there is more friction on the self-energizing than on the other shoe, the lining on the former will wear more rapidly. In practice, with this type of brake, the lining of the self-energizing shoe usually wears about twice as fast as that of the other.

So far as "helping the pedal" is concerned, only little benefit is derived from the self-energizing principle in a brake of the conventional type. There is a slight gain, because the friction on the self-energizing shoe is greater than that on the other, and the gain is equal to the difference between the moments around the anchor pin created by these frictional forces, because the moment of the applying force can be that much less. To obtain the full benefit of self-energization, both shoes must be made self-energizing. This, of course, means that the drum must pass over both shoes in the direction from toe to heel, or from the end where the actuating force is applied to the end where the shoe is anchored. This can readily be arranged, but in a brake with fixed anchors for the shoes, both would then be "de-energizing" during reverse motion, which would not be entirely desirable. With so-called "floating" shoes, with which one end is anchored during forward and the other during reverse motion, both shoes can be self-energizing during both forward and reverse motion. This is the principle of the balanced brake, and is illustrated by the diagram Fig. 3.

The brake comprises two wheel cylinders whose pistons transfer the hydraulic pressure to the brake shoes through the intermediary of cylinder caps. The two cylinders are connected in parallel, and brake fluid is forced into both at the same time, forcing the pistons apart. This brings the floating shoes into contact with the drum, and as soon as that occurs the shoes a carried around with the drum until t cylinder caps at the forward end of t shoes rest on the end of the cylinde the latter then serving as the anch for the shoe. Under reverse motion t shoes are carried around in the opp site direction, and the cylinder whi served as anchor for one shoe duri forward motion becomes the anchor f the other shoe. Both shoes therefo

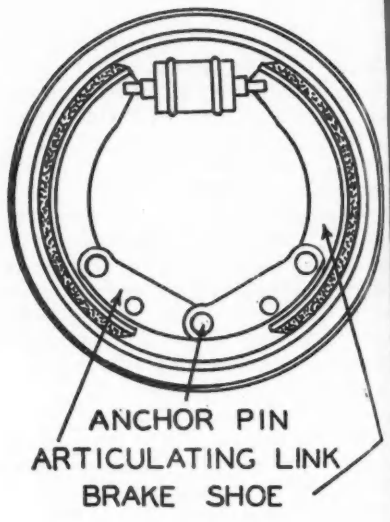


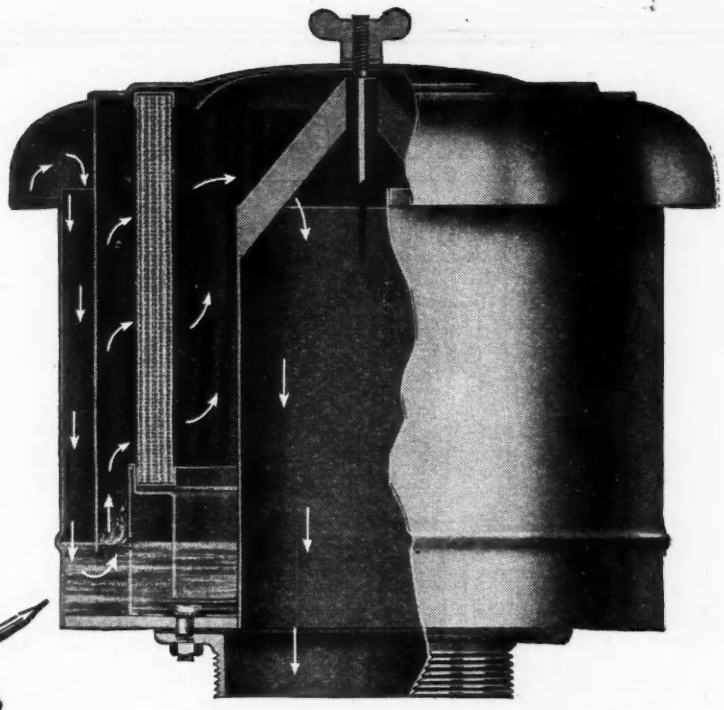
Fig. 3A—Huck type of "balanced" brake.

are self-energizing during both for ward and reverse motion.

Another design of balanced brake i the Huck type, an example of which i shown in Fig. 3A. As will be seen i the drawing, there is an articulatin link from a common anchor pin to th bottom of each brake shoe. This ar rangement of articulating links per mits the two shoes to float into positio with the drum.

The principal advantage of the bal anced brake, as compared with the con ventional one illustrated in Fig. 2, i that for a given pedal pressure it pro duces a greater braking effect, henc less pedal pressure is required for given braking effect. For instance, i the force of application were equal t that represented by C in Fig. 2, in balanced brake the friction on both shoes would be a little more than one third greater than in the conventiona brake, for the friction coefficient an brake proportions assumed. Hence, fo a given braking effect slightly les than 75 per cent of the pedal pressur would be required. The coefficient o friction may reach a value in excess o 0.60, and the reduction in pedal pres sure required is then proportionatel greater.

Other advantages of the balance brake are that, since both shoes ar pressed equally hard against the drum



Oil Bath Filter
Patented

Air Filter QUIZ

1. HOW HIGH IS THE DUST ARRESTMENT? Practically all popular filters for air intakes of engines, compressors and blowers have efficiencies ranging between 95% and 99%. But there are other important considerations in the selection of an air filter.

2. IS IT ALL METAL? All metal filters resist deterioration. Air-Maze all metal filters use a media of crimped metal screen mesh which does not "pack down", and density of media is the same throughout every square inch of filter surface. Metal filters are better able to withstand engine backfires.

3. DOES IT OPERATE ON THE VISCOUS-IMPINGEMENT PRINCIPLE? Air-Maze Filters do. They permit large air flow in small space and are not affected by moisture or oil-laden air.

4. IS IT AN OIL BATH TYPE? Most industrial applications demand the greater dirt-holding capacity and less frequent service of an oil bath filter. Air-Maze Oil Bath Filters vary in size from breather filters to large industrial units.

5. DOES IT HAVE LOW RESISTANCE TO AIR-FLOW? The advantage of low pressure drop is obvious. Because of the cylindrical design of Air-Maze Filters, the average drop in oil-wetted types is less than ⅛" w.g.; in oil bath types, less than 2" w.g.

6. CAN THE FILTER BE DISASSEMBLED AND CLEANED? A simple servicing operation restores oil-wetted filters to their original efficiency. The continuous washing action in oil bath filters keeps the filtering media clean and efficient. Air-Maze Oil Bath Filters are designed so that they can be easily and quickly disassembled and cleaned when necessary.

★ ★ ★

You get engineered filtration in every Air-Maze Filter. More than 3,000 Air-Maze products assure proper selection of the filter for special application. Your Air-Maze representative will recommend the best filter for your needs. Air-Maze Corporation, Cleveland 5, Ohio. Representatives in principal cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver.

IF IT USES AIR . . . USE
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ENGINEERED AIR FILTRATION
• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne dirt, oil, grease and liquids • Oil-wetted type filters and filter-silencers
• Exhaust spark arresters • Gear case, crankcase and tank vent breathers
• Oil-separators for engine crankcases • Full-flow type cleanable oil filters

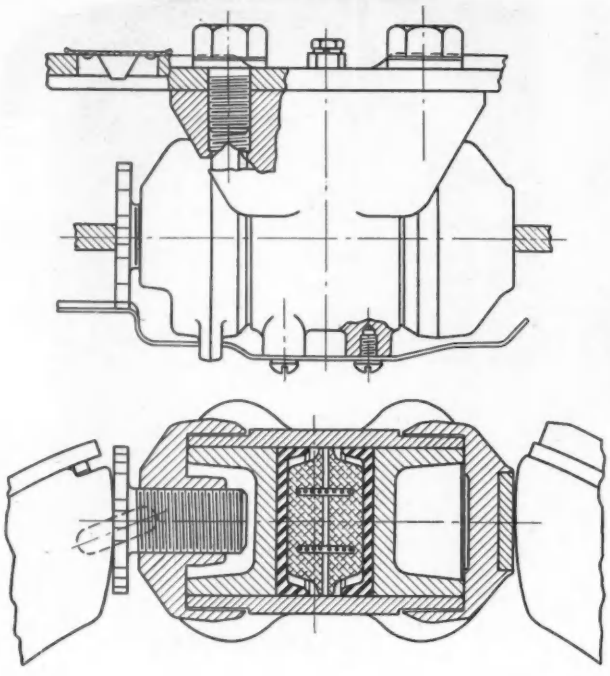

Fig. 4 — Two views of wheel cylinder of Bendix Twinplex brake.

both wear equally, and the actuating pressure is completely taken up within the drum, so that no loads are imposed by brake application on the axle or wheel bearing adjacent to the brake.

Bendix Products Division of Bendix Aviation Corp. markets a balanced type of brake under the trade name Twinplex. Two views of one of the expander cylinders of this brake are shown in Fig. 4. The upper view is a top view and shows how the cylinder is fastened to the brake backing plate by cap screws. It also shows the head of the adjusting screw, the spring which locks the adusting screw, and the opening in the backing plate through which adjustments are made and which is closed by a snap cover. The lower view is a vertical section through the cylinder, and shows the pistons with their rubber seals, the cylinder caps and the adjusting screw.

Still less pedal pressure than with the balanced brake is required with the servo brake, shown in diagram in Fig. 5. Here one shoe, known as the primary, is connected to the other by a strut or link. The single expander cylinder is located diametrically opposite from the strut, and there is an anchor pin directly above the wheel cylinder. The shoes are of the floating type, and are not articulated to the anchor pin, but merely abut against it—one shoe during forward motion, the other during reverse. When brake fluid is forced into the wheel cylinder, the shoes are "expanded" into contact with the drum, and then are carried around with it a short distance, until what is now the secondary shoe abuts against the anchor pin. In this brake the primary shoe is self-energizing, the same as in the two types already described, and produces a frictional force A (Fig. 2) for an actuating force C. The secondary shoe is actuated or applied by a force $C + A$, acting at the strut connection, and in addition is self-energizing, hence the frictional force of the secondary shoe is to that of the primary as $C + A$ is to C. Under the conditions assumed in Fig. 2, this ratio is about 2. Hence the secondary shoe does twice as much work as the primary. Therefore, representing the friction of a single self-energized shoe by 1.00, the total friction of a balanced brake will be 2.00 and that of servo brake 3.00, both for the same actuating force or pedal pressure. For a given braking effect the pedal pressures required for the different types of brakes therefore are approximately in the following proportions: Conventional brake, 1.35; balanced brake, 1.00; servo brake, 0.67.

With the servo brake, again, the two shoes press unequally against the drum, hence they wear unequally, and they also impose a load on the axle or wheel bearing. The drum, of course, also expands unsymmetrically.

The servo brake reached the production stage ahead of the balanced type, and has been used very extensively for passenger cars. Under normal conditions it is very satisfactory, but when an emergency stop has to be made, owing to the "light pedal," the driver is apt to lock the wheels and throw the car into a skid. In other words, he does not have as good control of the brakes as with other types. For this reason, at the present time the balanced brake with only a moderate amount of servo action, is preferred for high-speed vehicles of all types. The servo type of brake is quite suitable for large industrial vehicles, where powerful brakes are needed and where, because of the low speeds, there is little risk of loss of control. The better control of the non-servo types may be considered due to two distinct causes, one being that the driver can better gage the pedal pressure when it takes practically all the pressure he can exert to fully apply the brakes, than when it takes only half as much; the other is that with servo action the braking effect varies more rapidly with a change in the coefficient of friction than without such action.

A brake which functions as a balanced one during forward, but substantially as a conventional brake during reverse motion is being marketed under the trade name Hi-Tork by the Wagner Electric Co. A diagrammatic sectional view is shown in Fig. 6. It was pointed out in the foregoing that a balanced brake requires two expander members—wheel cylinders, cams, etc. The Wagner, which operates hydraulically, has two wheel cylinders combined in a single unit and communicating with each other, so that only a single hydraulic connection needs to be made. The piston in one cylinder acts directly on one of the brake shoes, while that in the other cylinder, of approximately one-half the bore of the former, acts on the other brake shoe through the intermediary of a lever. The arms of the lever are of unequal length, and the leverage thus obtained makes up for the difference between the bores, so that substantially equal pressures are applied to the toes of both shoes. On forward motion the drum moves over both shoes

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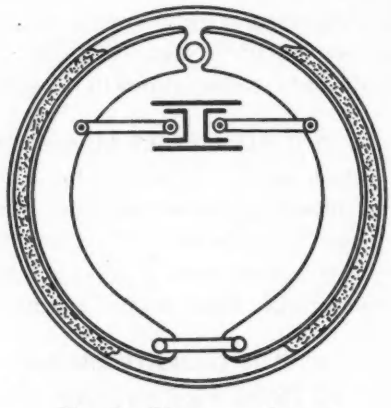
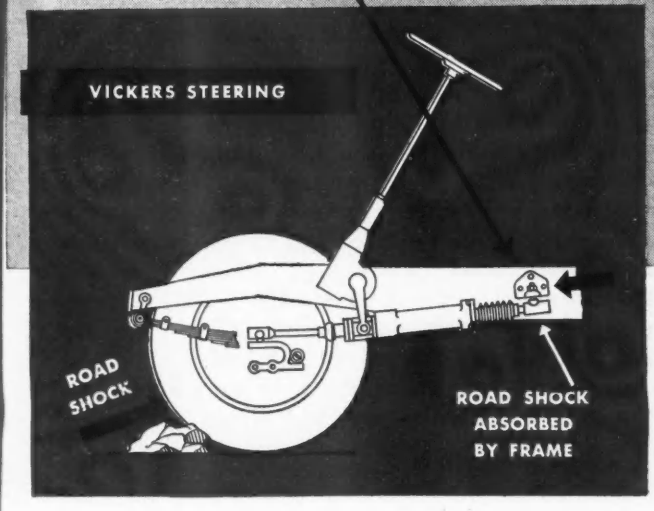
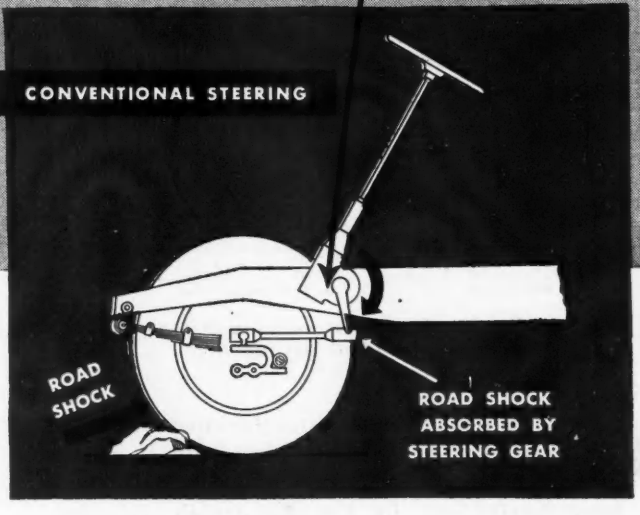


Fig. 5—Diagram of servo brake.

VICKERS Hydraulic POWER STEERING

Transmits Road Shock Thrusts to the *FRAME... instead of to the Steering Gear*





With Vickers Hydraulic Power Steering, no road shock can be transmitted to the steering gear and to the driver . . . road shock thrusts are transmitted to the frame. A vehicle can be driven over the curb, through sand, and on rough ground with no "fight" from the wheel. A flat tire will not cause swerving. A light touch on the steering wheel is sufficient at all times.

Among the many other important advantages of Vickers Hydraulic Power Steering are: greater driver efficiency by reducing fatigue to a minimum, easy application to existing chassis designs, automatic overload protection for both hydraulic system and steering linkage, and 15 years of successful operating experience on trucks, buses, road machinery, etc. Ask for Bulletin 44-30 which contains complete information about the Vickers Hydraulic Power Steering System.

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VICKERS Hydraulic POWER STEERING is Simple . . . Compact . . . Easily Installed

Chemical Surface Treatments for Gear Teeth

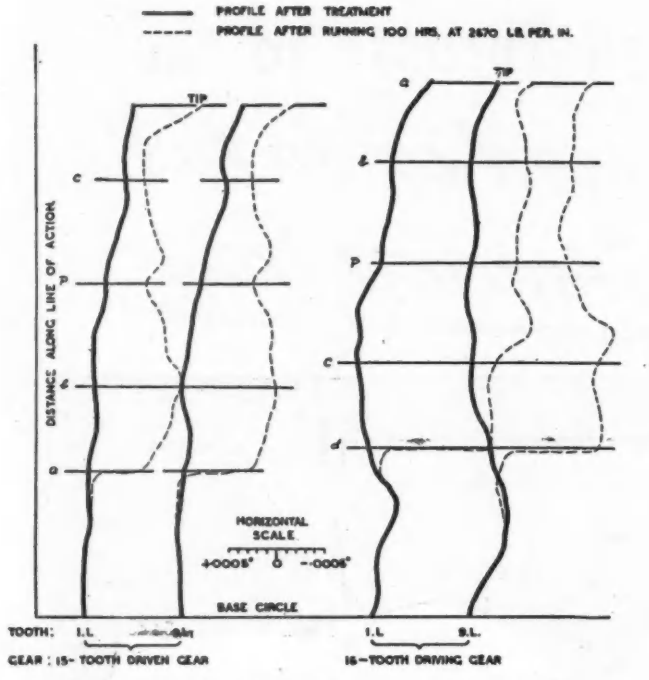

Fig. 1—Profile diagram of running-in tests on a deep phosphate treatment.

A SERIES of tests to determine the effectiveness of various chemical surface treatments as means to prevent or delay failure of gears by scuffing has been carried out by the Automobile Research Committee of the Institution of Automobile Engineers (Great Britain). The results are considered sufficiently promising to warrant experimental application of one class of the chemical treatments investigated —phosphating—in cases where scuffing is likely to occur. The treatments applied to the gears were essentially the same as those applied in this country to piston rings and certain other parts to prevent scoring. Following is an abstract of a report on the test, which was drawn up by H. D. Manson and issued by the Institution.

A study of the subject suggested that treatments to be investigated might include the following:

(I) Phosphate treatments of various types.
(II) A caustic soda-sulphur treatment.
(III) Electrolytic tin-plating.
(IV) An anodic deposition of colloidal graphite.
(V) A nitric-acid etch treatment.

A treatment to be satisfactory for gearing must meet the following requirements: (a) it must give appreciable protection against scuffing; (b) the gear must not be rendered more liable to failure by either pitting (surface fatigue) or by tooth breakage (bending fatigue); (c) the dimensions or shape of the gear must not be materially changed, although a small build-up on the surface is not objectionable, as a rule.

For ordinary case-hardened gears, treatments carried out at above 300 F would be ruled out, on account of their effects on the metallurgical structure. It was considered desirable also to determine whether the inhibiting effect of the treatment as regards scuffing was permanent, or whether it wore off.

The various surface treatments were tested by running standard scuffing tests on gears treated, and comparing the scuffing loads with those for similar untreated gears. Three types of tests were run, as follows: (1) direct scuffing tests to find what degree of protection was initially imparted to the gear; (2) running-in tests, to investigate the wearing or lasting quality or the surface treatment, and (3) endurance tests to indicate what effect, if any, the surface treatment had upon the liability to fatigue failure.

The gears used were of 5 d.p., 15 and 16 teeth, with approximately 26 deg working pressure angle; they were run at a center distance of 3¼ in. The face width was 3/16 in. All were of case-hardened nickel-molybdenum steel (S.A.E. No. 4615), drawn up at 340 F to show between 700 and 750 V.P.N. The gears used for the direct-scuffing and for the running-in tests had almost unmodified involute profiles, while those used for the endurance tests were given consid-

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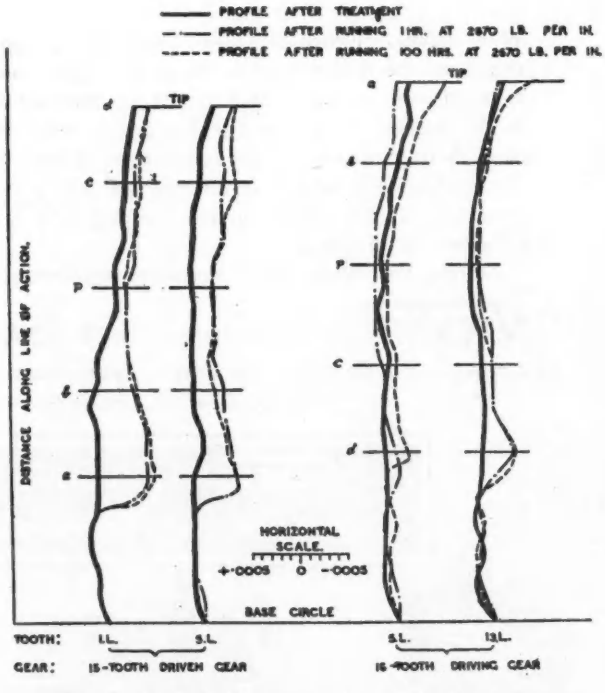
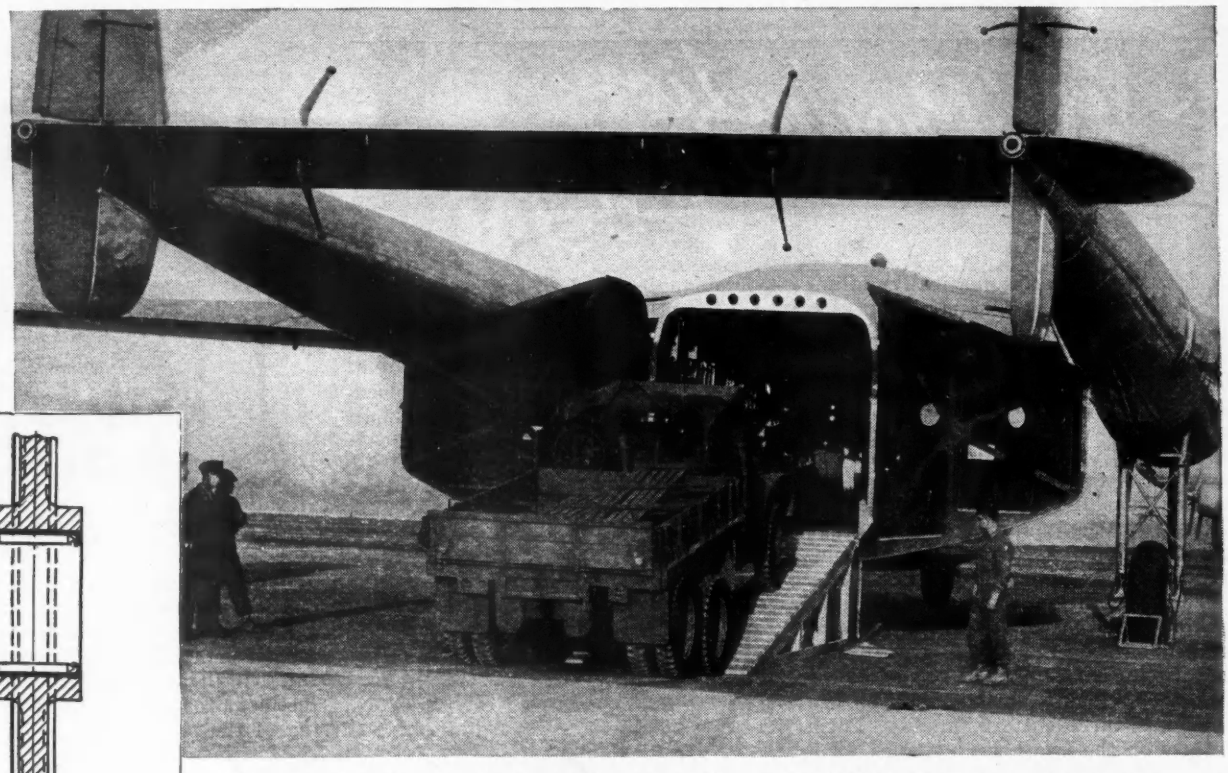
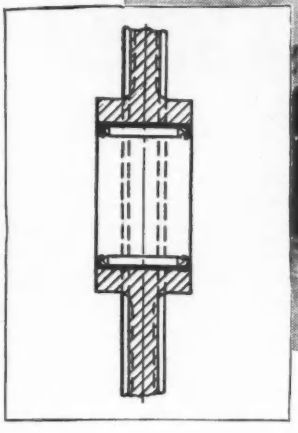

PROFILE AFTER TREATMENT
PROFILE AFTER RUNNING 1 HR. AT 2670 LB. PER IN.
PROFILE AFTER RUNNING 100 HRS. AT 2670 LB. PER IN.
TIP
DISTANCE ALONG LINE OF ACTION
HORIZONTAL SCALE
+0005 0 -0005
BASE CIRCLE
TOOTH: I.L. S.L. S.L. I.L.
GEAR: 15-TOOTH DRIVEN GEAR
16-TOOTH DRIVING GEAR

Fig. 2—Profile diagrams of running-in tests on a deep phosphate treatment.



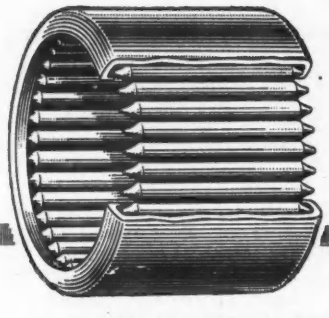


X-section shows how nacelle door cable pulleys of famous Fairchild C-82 Packet turn on compact, efficiently-lubricated Torrington Needle Bearings. This is one of many applications of these light but sturdy anti-friction bearings to the most modern and efficient aircraft.

Torrington Needle Bearings Carry Heavy Load on Fairchild C-82 Packet

Critically important to the success of the Fairchild C-82 Packet is the care with which its designers have seen that each component part does its job with maximum efficiency and dependability combined with minimum cost in weight and size. That's why the nacelle door cable pulleys, for example, operate on sturdy, compact, *anti-friction* Torrington Needle Bearings. "Needle Bearings were used in this application," Fairchild's Engineering Department reports, "because they were lighter and more compact than any other bearing capable of carrying the same load."

You and your engineers and designers should know of these and other Torrington Needle Bearing advantages in specific terms of your product's requirements. You should know how they increase design and operating efficiency of aircraft, automotive and related equipment where you want maximum performance and dependability for minimum size, weight and cost. Our Catalog 32, showing the wide range of types, sizes and proved-in-use applications, belongs in your files. Why not write for your copy today?



THE TORRINGTON COMPANY

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TORRINGTON NEEDLE BEARINGS

New Production Equipment

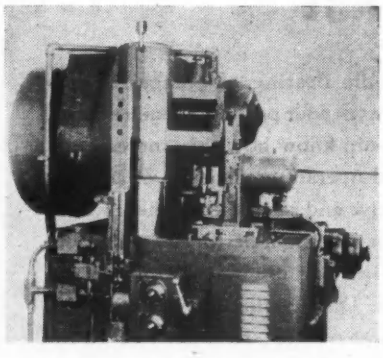
A MACHINE for automatically milling and cutting off parts from bar stock at high production rates has been introduced by Kent-Owens Machine Company, Toledo, Ohio. Its operation is entirely automatic. One operator can tend two or more machines, his only duty being to insert new bar lengths as they are exhausted.

This machine is said to be ideally suited for the manufacture of hinge parts, pole pieces, turbine blades, molding, hardware and many other parts.

The illustration shows a set-up for milling turbine blades. The crescent shaped bar stock is automatically fed against an end stop by a torque motor and then clamped hydraulically. The head has three cutter spindles. Form cutters on the two lower spindles form mill the blade and a saw on the upper spindle cuts the blade off to length.

The head is actuated hydraulically with proper adjustments so that any desired cycle or feed rate may be obtained. The hydraulic pump and motor are enclosed in the base of the machine.

A proper fixture and clamping jaws



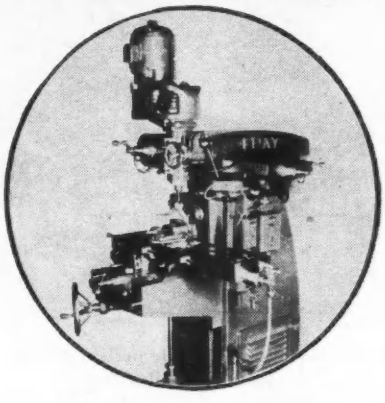
Kent-Owens automatic bar stock machine

can be provided to accommodate various cross section shapes of bar stock. Further, the head can be furnished with a single spindle for simple cutting off operations or with a number of spindles for both milling and cutting off as in the example described.

FRAY MACHINE TOOL COMPANY, Glendale, Cal., announces a new model milling machine, Fray No. 9, turret head, ram type, built for vertical or horizontal work operations. It features variable speed to power feed, achieved by an electronic control panel built-in as an integral part of the equipment.

Since it is both a horizontal and vertical precision milling machine, almost any operation at any angle or compound angle can be completed without changing the original work set-up.

One control panel, made by Westinghouse, is the operating focal point of the unit. Design of the unit and location of the control panel make it pos-

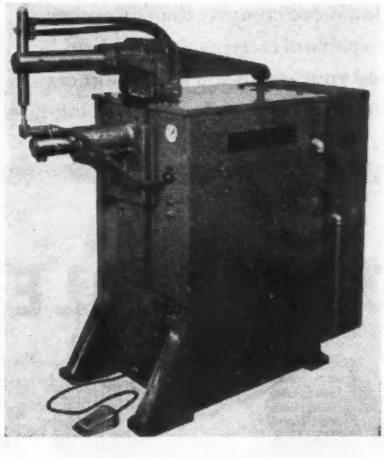


Fray milling machine

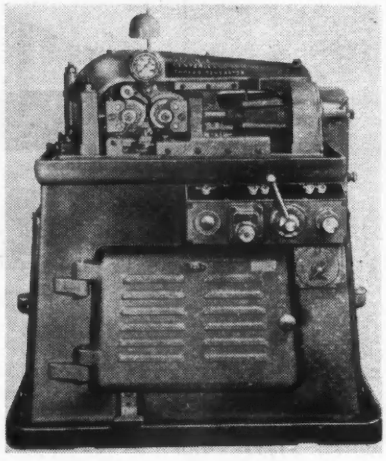
sible for the operator to handle all adjustments without leaving his position in front of the machine or work set-up.

PRECISION WELDER AND MACHINE CO., Cincinnati, Ohio, has brought out a rocker arm, air-operated spot welder which embodies present adjustments and functions of conventional welders, and is designed to take advantage of the latest knowledge gained in the resistance welding field.

Use of air terminal block increases speed of operation to over 200 spots per minute and keeps piping to a minimum. The solenoid air valve can be removed without removing piping or wiring. Sides of machine are kept clear for material handling and stor-



Precision welder



Steinle centerless thread generator

age in keeping with motion-time production methods.

A completely new design of transformer mounting clamps the core the full length and provides complete adjustment for accurate and rigid mounting of the transformer.

STEINLE MACHINE CO., Hartford, Conn,. is marketing the Steinle centerless thread generator which uses the principle of the centerless grinder and carries the workpiece, on the work rest, so that its center line is slightly below the centers of two circular forming rolls.

The rolls, of hardened steel, have their periphery faces precision ground with a precise negative reproduction of the helix angle, pitch and form of the

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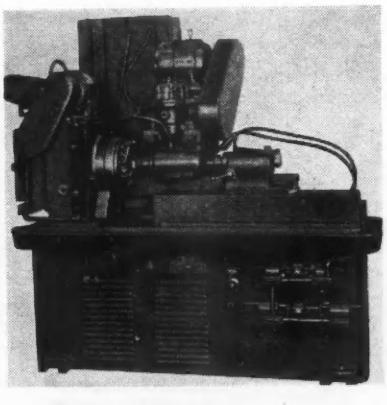
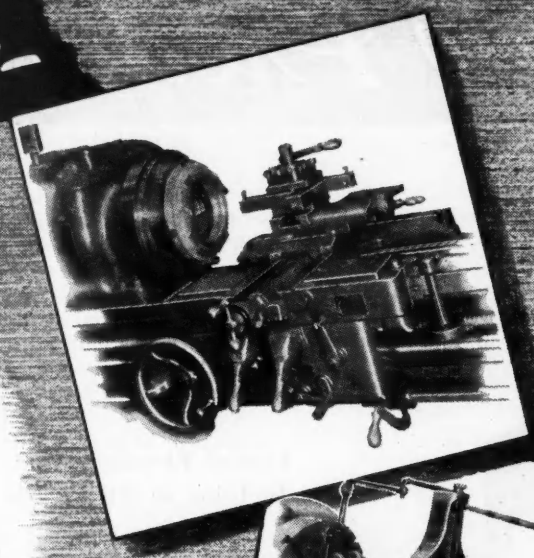
Special Milling Machine



This machine was designed by Snyder Tool & Engineering Co., Detroit, Mich., to process work pieces from ¾ in. diameter by 4 in. length up to 6 in. diameter by 24 in. length. In this particular application, it is used for milling lubricating slots in tapered valve plugs. Indexing is by means of a motor-driven Geneva mechanism, including a positioning pin and a master control drum governing the length of travel of the milling cutter head. This mechanism automatically selects a long or short cut to be taken along the work-piece.

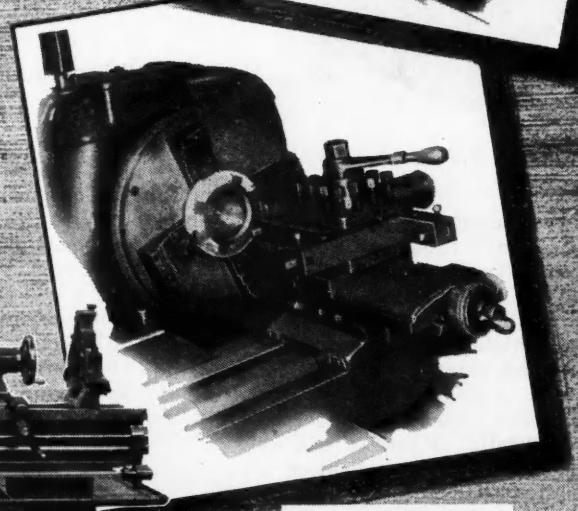
LODGE & SHIPLEY LATHES AT WORK—

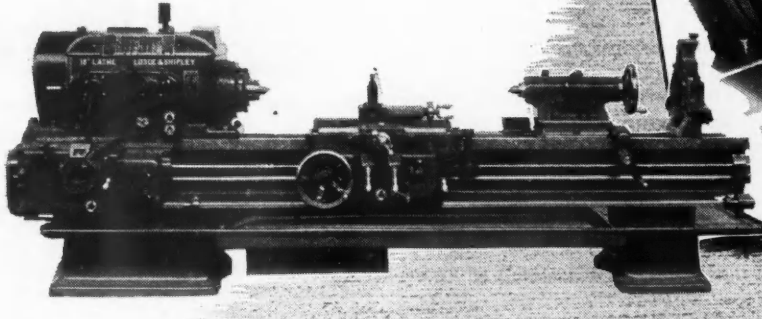
on castings . . . aluminum and steel



Aluminum casting; O. D. 15½ inches, bore 9¼ inches; weight 4½ pounds; Operation—face, bore, turn, and form grooves; speed 216 rpm, .008 inch feed.

Steel casting; length 27⅝ inches; weight 118 pounds; Operation—face, turn, bore, counterbore, ream and groove; speed 169 rpm, .006 inch feed. Bores and counterbores must be concentric within .001 inch.





Aluminum casting; O. D. 8 inches, bore 4½ inches; weight 1.3 pounds; Operation—face, bore, turn, and form grooves; speed 216 rpm, .008 inch feed.

To machine tough castings of intricate design is no job for an ordinary lathe. Illustrations show several castings which must pass the most critical inspection at the Erie Works of the General Electric Co.—machined on the new Lodge & Shipley 18, 20, 22 inch Lathes.

Completely new in every part, these L & S Lathes set up improved standards of accuracy, production and smooth operation. A wider range of speeds, feeds and threads permit full use of all cutting tool possibilities, increase versatility of these lathes.

Bring your lathe problem to L & S Engineers—they're backed by 53 years of specialized lathe experience. For further details on these new lathes, write on your company letterhead for Bulletins Nos. 503, 605.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

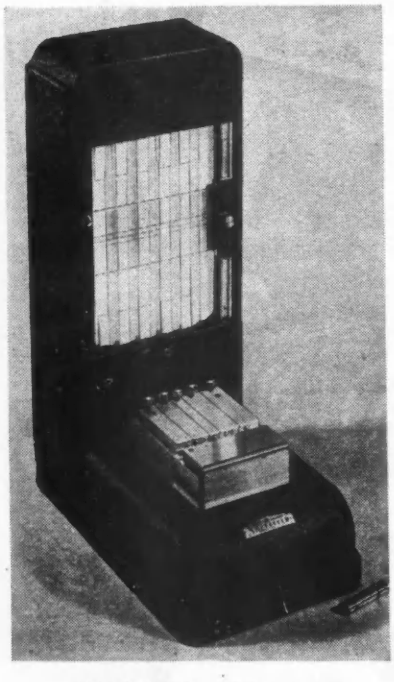
L & S LATHES

ENGINE—TOOL ROOM—AUTOMATIC—OIL COUNTRY LATHES

New Products

High Amplification 5-Tube Precisionaire

A high amplification five-tube Precisionaire, developed by The Sheffield Corporation, Dayton, Ohio, is an example of the almost unlimited possibilities of air gaging.



Sheffield Precisionaire

Five tubes, each capable of providing an amplification of 18,000 to 20,000 to 1, are combined in one instrument to check 10 points along the ½-in. diameter of a highly critical part. The tolerance at each point is plus-or-minus five millionths of an in. (0.000005 in.). Out-of-roundness, taper and undersize or oversize conditions are disclosed. The part for which this application is designed mates with a part which is checked by a similar high amplification Precisionaire.

"Non-Spatter" Welding Film

A liquid designed to minimize the adherence of welding spatter to metal and reduce cleaning time has been introduced by The Lincoln Electric Company, Cleveland, Ohio. This new product is known as Lincoln "Non-Spatter" film. The liquid is said to possess the following characteristics: Welding can proceed after application, whether the film is still wet or dry, film can be sprayed or painted on work, priming coats of paint may be readily applied over the film, if it is desired to remove the film before painting, this can be readily accomplished by washing with water, one application of film is effective for multiple-pass welding.

If film is sprayed or painted on parts prior to being normalized, the oxide film and ordinary scale can be removed more easily after heat treating.

Coated Electrode for Welding in All Positions

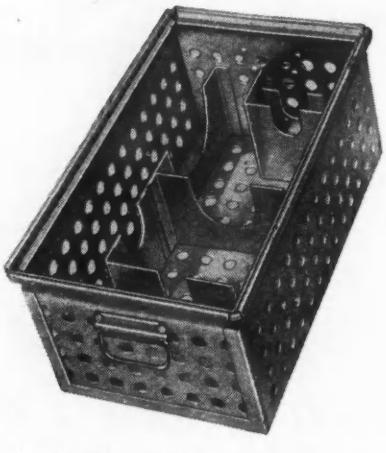
For welding in all positions and with a-c and d-c reverse polarity, the new ACP electrode available in seven diameters from 5/16 in. to 3/32 in. is announced by the Westinghouse Electric Corp.

The new heavily coated electrode, for high-quality welds on work which is not easily positioned, forms a light, porous slag which is easily removed from each pass by light brushing. Because of the high tensile strength and ductility of welds made with ACP, this rod is said to be especially suited for heavy plate fabrication, shipyard, pressure piping, pressure vessels and general structural steel work.

Shop Piling Boxes for Assembly Line Use

Partitioned shop piling boxes for use on assembly lines are built to order by the Shop Equipment Division of the Cleveland Wire Spring Co., Cleveland, Ohio. The boxes may be made to hold a pre-determined number, or a complete set, of parts required for a given assembly or sub-assembly of any machine or other piece of equipment.

In addition to the conventional function of any shop box, this box has the advantage of eliminating errors and saving time on the assembly line, because every part needed by the assembler is always found in the same pigeon-hole in the box which, when filled to capacity, always contains the exact number and the right sizes required for a given purpose.



Partitioned shop piling box

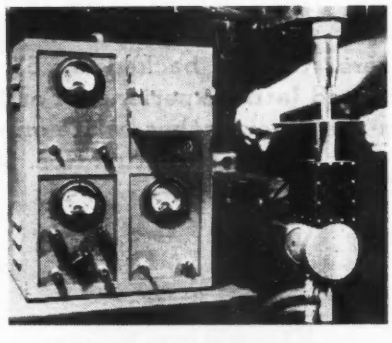
The partitions may be fixed or removable, freeing boxes for conventional uses when not needed for their assembly function; or they may be converted for use on new or different models by replacing only the partitions.

Rustproofing for Tubes

Nox-Rust Corp., Chicago, Ill., has added a new member to its list of specific-purpose rust preventives. It is called Nox-Rust Tube Coating. The maker says that it prevents tube rust in transport or storage. It doesn't run off during transportation. Nox-Rust Tube Coating dries into a firm, dust-free film.

Recorder for Checking Welder Performance

A new current-force recorder for recording current and force in resistance welding machine electrodes has been added to the line of the General Electric Co. Desirable for use in welding research and for the periodic checking of welding machine performance, the new recorder is specially designed to be helpful to users of energy-storage type welding machines for determining when forge pressure is applied to the work with respect to the discharge of welding current. In addition, the recorder permits resistance welding machine users to comply with Navy specifications, Navaer PW-6A, Bureau of Aeronautics, specifications for the spot welding of aluminum alloy, for Class A spot welding.



G-E current-force recorder

New System for Selling and Delivering Gasoline

An anticipated return to production of a new system for the petroleum industry which may revolutionize present methods of selling and delivering gasoline to the service stations was an-

(*Turn to page 78, please*)

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

One of the obstacles in the way of large-size home television is the cost of the necessary aspherical lenses. A new material and method makes it now possible to mold these accurately of plastic at much lower cost. *Polaroid Corp.*

get ready with CONE for tomorrow

A "plastic foam" has been developed that is semi-rigid and weighs only about one-seventh as much as cork.—*U. S. Rubber Co.*

get ready with CONE for tomorrow

A western college is preparing courses in the management of small business, particularly for returned veterans. *Western Reserve University.*

get ready with CONE for tomorrow

Before the war we imported about one million glass eyes from Germany. Now an American manufacturer is reported to be filling a Russian order for 50,000 plastic eyes and to promise them for the use of our civilians later in the year. *American Optical Co.*

get ready with CONE for tomorrow

Three coal companies and six railroads are to collaborate in a million dollar research program to improve the coal burning locomotive. *Bituminous Coal Research, Inc.*

get ready with CONE for tomorrow

An automobile manufacturer is expected to enter the farm market with a number of new tools including a modified flame thrower for killing weeds. *Graham-Paige Corp.*

get ready with CONE for tomorrow

A new electronic piston ring inspection instrument uses beams of light to check accuracy within 0.001 inches in less than five seconds. *Sheffield Corp., Dayton.*

get ready with CONE for tomorrow

A new process claims to be able to electroplate aluminum with any of the conventional plating metals. *Alumon Euthone Co., New Haven.*

A new glass resists heat up to 1650 degrees Fahrenheit. *Vycor—Corning Glass Works.*

get ready with CONE for tomorrow

A new Diesel engine burns natural gas, coke-oven gas or sewage gas, as well as oil, without shutting down to exchange parts. *Cooper-Bessemer Corp.*

get ready with CONE for tomorrow

A new anodizing process makes magnesium resistant to corrosion. *Consolidated Vultee.*

get ready with CONE for tomorrow

The craft of gem cutting is being taught in this country to returned veterans in an effort to hold the advantage in this field that the war has given us. *Gabriel Williams, N. Y.*

A 96-pound bearing produced by powder metallurgy is claimed to be the largest of its type yet made. *Chrysler Corp., Amplex Div.*

get ready with CONE for tomorrow

The first direct drive steam turbine locomotive to be built in the United States is undergoing tests to determine its adaptability to long-distance high-speed freight and passenger service. It is said to be capable of pulling a passenger train at 100 miles per hour. *Penn. RR Baldwin Locomotive Works—Westinghouse.*

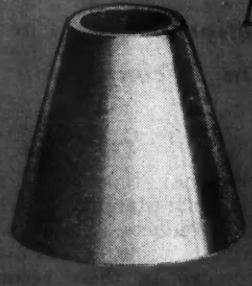
get ready with CONE for tomorrow

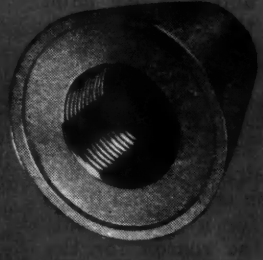
A photographic technique is claimed to be so sensitive that it will record even differences in air pressure such as shock and sound waves or air jets. *Schlieren Method—General Electric.*

get ready with CONE for tomorrow

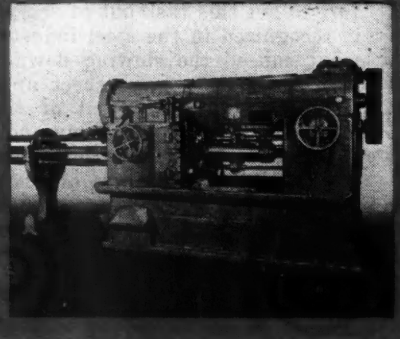
A new dynamometer can stop a 158 ton wheel, whirling 3 miles per minute in 18 seconds. *Westinghouse.*

Making Time on the Road to Tokyo





The 2¾", 6-Spindle Conomatic uses 11 tools to complete this part, with its 4 inside diameters in 18 seconds.



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

19

Cutbacks in War Production Increasing in Tempo

Rate of Contract Cancellations and Readjustments in Automotive Industry Now Exceeds Earlier Expectations

War production cutbacks, which lagged for a time after the initial flurry just before and after V-E Day, are beginning to come through at an increasing tempo. Henry P. Nelson, WPB conversion co-ordinator for the automotive industry stated recently that they were coming at the rate of one every 15 min. The automotive industry has had its share of reductions and outright cancellations of war goods in recent weeks.

One of the major cancellations was the $100 million termination of the Studebaker contract for 2½-ton cargo trucks, effective July 31. The company had been slated to produce 44,000 of the trucks between Aug. 1 of this year and July 1, 1946. About 429 sub-contractors will be affected. The cancellation was the second one for Studebaker within two weeks, since its aviation engine program had been cancelled shortly before. The truck cancellation does not materially aid the company in its reconversion activities, since it will continue to use its truck line for some commercial trucks, and it cannot build cars and trucks on the same line. The automobile assembly line still is tied up with work on the "Weasel" cargo carrier, but it is understood that preparations are underway to remove this job to another part of the plant. GMC Truck and Coach Div. of GM also has been building 2½-ton trucks, and it too is reported slated for a sizeable cutback. Apparently the reason for the outright cancellation of the Studebaker contract is that these trucks were primarily for Lend Lease to Russia and other Allied countries, although the U. S. Army used some of them. The company built about 200,000 of the vehicles, which were the 6 x 4 and 6 x 6 type.

Reo Motors, Inc., is another truck manufacturer to lose its contract for 2½-ton trucks. Its contract terminated June 30. At Chrysler Corporation, a contract for ¾-ton Dodge weapon carriers and spare parts will be partially terminated as of July 7, but other truck production will continue at full rates. The company now is negotiating with the Army for additional war vehicles and is working with other branches of the government to increase its allotment of civilian trucks. The result of the various cancellations in the truck industry has been to step up sharply the estimates by truck makers of the capacity they will have over the additional 188,000 units WPB has authorized during the second half of this year. At last reports, WPB was considering giving priority assistance only on the 188,000 extra trucks, however.

At the Lincoln plant of Ford Motor Co., production of tank engines has been reduced to the extent that the plant now is on a five-day week although there will be no reduction in employment. Output during June was reduced 200 engines. Production of engines now on order will keep the plant busy until next March if there are no further cutbacks, although the reduced volume will eliminate the need to move operations to the Buffalo branch as had been planned earlier, leaving that plant free for reconversion to automobile assembly. It now is being operated as a parts depot, but is being made ready for car production. As it stands now, Ford is in relatively good shape so far as free plant space is concerned. Car operations will start first at the Rouge plant, and the Dallas, Louisville, and Richmond, Cal., plants will be ready to go by the end of July. The Edgewater, N. J., plant also soon will be in shape for resumed car operations. When the postwar picture is completed, Ford will have 15 assembly plants in operation.

Along this same line, it is reported that initial production of Chevrolet cars will be undertaken at four branch plants—Janesville, Wis.; Kansas City;

(*Turn to page* 88, *please*)

Finishing Mills May Meet Civilian Demand for Sheet and Strip Steel

Restoration of New Car Market Looked upon as First Move in Reconversion of Continuous Rolling Mills

By W. C. Hirsch

Evidence that those who supplied automobile manufacturers with finished steel products in pre-war years look upon restoration of this market as the first move in their reconversion program is seen in the speed-up of the change-over from plate to sheet equipment of their continuous rolling mills. It is not only in the larger units of the steel industry that this preparatory work is going forward at as fast a rate as the inadequate supply of efficient mechanics permits, but the smaller specialty mills also are bending every effort to get this task out of the way. It is recognized in the steel industry that what caused the slowing down of deliveries of light gage sheet and strip steel was not the extent of the tonnages required by the Army and Navy, but the diversion of so many continuous mills to the rolling of plates for ships. When a representative of the armed forces stated, at a recent conference of WPB and sheet and strip producers, that military needs of light gage sheet and strip steel in the war against Japan would be only slightly less than they were in the two-front war, the producers were not greatly perturbed. With the demand for ship plates expected to dip more and more from now on, it will be possible to increase the sheet and strip capacity of finishing mills to the point where all Army and Navy needs can be easily met and whatever civilian demand is approved by WPB satisfied as well.

According to a WPB release under date of June 18, the steel ingot capacity of the United States has been lifted from 80 million tons annually, before the war, to 95 million tons. Of this increase of 15 million tons annually, 2,500,000 tons has resulted from expansion of capacity in the West and West Coast areas. This statistical showing is considered as encouraging confidence in orderly post-war market conditions. The level of post-war consumption of commodities in general is expected to rise well above the increase in steel capacity indicated by this showing. On the other hand, had expansion been permitted to get out of hand, the excess of capacity over what could be reasonably expected after the war to be normal consumption would have exerted a possibly dangerous strain on the market. One of the worst headaches of the steel industry just now is caused by the contraction of free tonnage of pig iron supplies, sec-

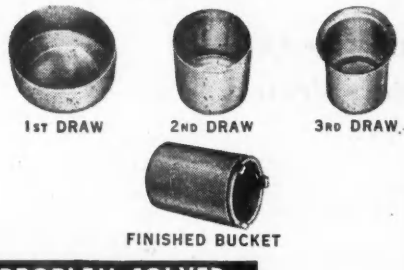
(*Turn to page* 85, *please*)

YOU GET CORROSION RESISTANCE

Plus... Easy, Low Cost STAMPING, FORMING, DRAWING *with Carpenter Stainless*

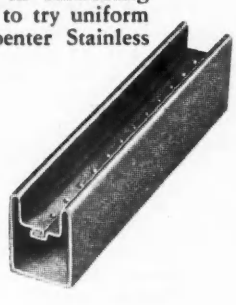
NO PROCESS ANNEALING

was needed to deep draw this steam trap bucket. Have you considered the economies you can gain and the trouble you can avoid by making your deep drawn parts from easy-working Carpenter Stainless Strip?



TOUGH PROBLEM SOLVED

This lock seam presented a difficult fabricating problem until Carpenter Stainless Strip went on the job. If you are having difficulties in fabricating stainless parts, be sure to try uniform soft and ductile Carpenter Stainless Strip.



Have you considered the greater utility advantages you can get by using Stainless Steel in your products?

For instance, you can give your products positive protection against heat and corrosion; you can provide them with 50% greater strength than ordinary cold-rolled steel; you can choose from a wide range of physical properties to meet specific requirements.

Just be sure when you select a Stainless Steel that you get one that works easily and economically in your fabricating shop. Carpenter, for instance, has spent years of intensive research developing soft and ductile Stainless Strip that blanks cleanly, forms readily, deep-draws easily. Exacting control through every step in manufacture, gives this Stainless Strip the consistent uniformity, lot after lot, that pays off in faster production runs with fewer rejects and less die wear.

Call in your nearby Carpenter representative today and let him help select the Stainless Strip that will make your production job easier and build extra service life into your products. And if you do not already have a copy of "Working Data for Carpenter Stainless Steels," drop us a line on your company letterhead.

GIVE YOUR PRODUCTS THESE ADVANTAGES WITH CARPENTER STAINLESS

- Strength and Rigidity
- Heat Resistance
- Weight Saving
- Freedom from Rust
- No Plating to Peel
- Ease of Assembly
- Longer Product Life
- Sales Appeal

The Carpenter Steel Company • 103 W. Bern Street • Reading, Pa.

Carpenter STAINLESS STEELS

BRANCHES AT
Chicago, Cincinnati, Cleveland, Detroit, Hartford, Indianapolis, New York, Philadelphia, St. Louis

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Fluctuations of general business activity have remained within a narrow range. The *New York Times* index for the week ended June 2 declined to 142.2 from 143.4 in the preceding week, as against 143.8 a year ago.

Electric power production resumed an upward trend in the week ended June 9 and was 1.5 per cent above the comparable level last year, as against a similar rise of 1.4 per cent recorded a week earlier.

Railway freight loadings during the same period totaled 884,285 cars, 5.6 per cent more than for the week before and 1.3 per cent above the corresponding number a year ago.

Crude oil production during the week ended June 9 averaged 4,853,414 barrels daily, 5301 barrels below the figure for the preceding week but 330,914 barrels more than the output a year ago.

Production of soft coal in the week ended June 2, reflecting the influence of a holiday, is estimated at 11,170,000 net tons, as against 11,825,000 a week earlier and 11,652,000 tons a year ago. The output thus far in 1945 is 7.8 per cent below the corresponding quantity last year.

Engineering construction contracts awarded during the week ended June 14, according to *Engineering News-Record*, totaled $59,216,000, the highest weekly sum reported since last August. This amount is 38 per cent above the figure for the preceding week and 102 per cent greater than the comparable sum a year ago. For 1945 to date, the contract total is 5 per cent below the corresponding amount in 1944.

The *Journal of Commerce* weekly index of wholesale commodity prices as of June 9 was unchanged at 111.2 per cent of the 1927-29 average, as against 108.4 in June a year ago.

Member bank reserves increased $319,000,000 during the week ended June 13, reflecting a rise of $140,000,000 in total Reserve Bank credit, a decline of $82,000,000 in Treasury deposits with the Reserve banks and other changes. Excess reserves rose to an estimated total of $1,380,000,000. During the preceding week, earning assets of reporting member banks rose $713,000,000, including an increase of $53,000,000 in commercial, industrial and agricultural loans.

Extension of Patents Considered in Congress

Three bills, recently introduced in Congress, should be of interest not only to all holders of United States patents, but to industry in general. These bills, which are now pending before committees, provide for the extension of patents whose use has been prevented by the war.

A bill to extend unexpired patents for periods equal to the length of time such patents shall have been in force during the war (S. 840) was introduced in the Senate by Mr. Capehart. Mr. Rowan introduced a bill (H.R. 2043) in the House of Representatives to provide for the extension of patents whenever the use of the same is prevented by war or other causes, while the bill (H.R. 3069) introduced in the House by Mr. Grant of Indiana would extend unexpired patents for periods equal to the length of time such patents shall have been in force during the war.

The House Committee has not decided upon a date for hearings, if any are held. The bill before the Senate Committee may possibly be considered within the next week or two, but reports indicate that such consideration is not a probability.

ACC Changes Name

The Aeronautical Chamber of Commerce of America, Inc., the national association for the aircraft manufacturing industry for more than a quarter-century, has changed its name to Aircraft Industries Association of America, Inc.

The name change was voted by the association membership to avoid confusion of the aircraft organization with Chambers of Commerce and other aeronautical bodies.

Avco Buys Controlling Interest in Crosley Corp.

The Aviation Corporation has purchased controlling interest in the Crosley Corporation from Powel Crosley, Jr., and family. The sale is subject to approval of the Federal Communications Commission because radio station WLW and other broadcasting facilities and applications are included in Crosley assets.

Under terms of the purchase, Avco acquires approximately 64 per cent of Crosley Corporation's 545,800 shares at a price of $39 a share. A similar offer is being made to minority stockholders. Both are cash transactions involving a total commitment of $22,000,000. A bank credit with ten banks participating has been arranged by Avco to finance the purchase.

Purchase of Crosley by Avco does not include the Crosley automobile division, representing less than 3 per cent of the company's total assets. Mr. Crosley plans to form a new company to manufacture the Crosley car and all stockholders of the Crosley Corporation will be given an opportunity to acquire a pro-rata interest in the new company.

Dissatisfaction with New Car Quotas Indicated; Ford Registers Protest

Ford Motor Co. has made a protest to the War Production Board on the method followed in allocating automobile production for the last half of this year. They say: "We feel that it is discriminatory against both our dealers and our suppliers. Our dealers will receive about four cars per dealer, whereas, dealers representing some of the smaller independents will receive many times that number. The allocation also works a hardship on our company, as it fails to take into consideration the fact that we will be operating at less than 10 per cent of our prewar output, whereas one of the independents will be operating at nearly 100 per cent of its prewar output and another at about 15 times its prewar production. We don't understand why each company was not given its rightful share of the available materials based upon prewar experiences. Instead, several of the independents are permitted to operate at levels nearly as high or much higher than prewar schedules. We registered no protest to an allocation of materials for newcomers—we welcome competition."

Although only Ford filed a formal protest with WPB, there are indications that other large manufacturers are substantially in agreement with the discriminatory charges made by Ford.

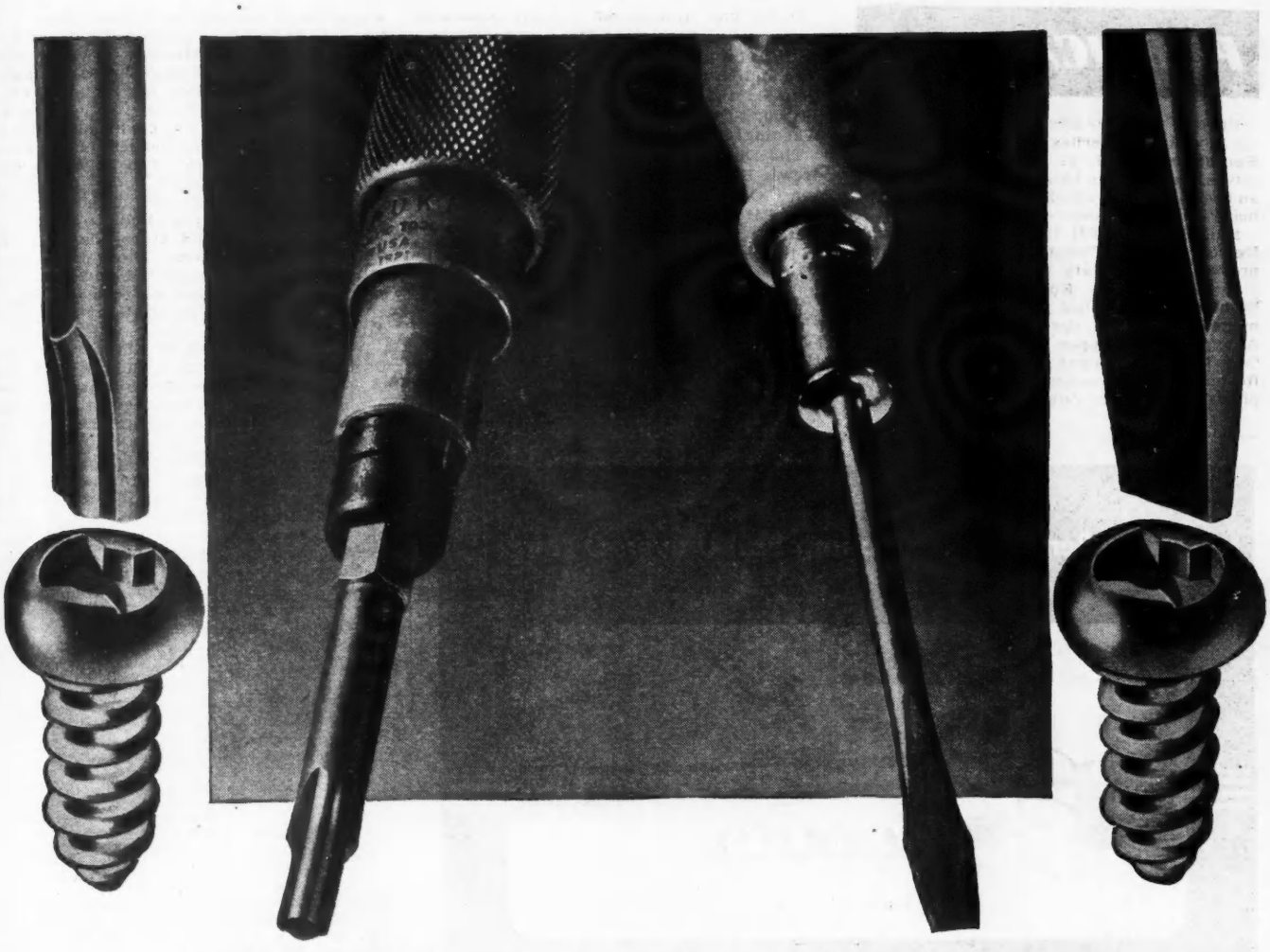
However, the War Production Board stood firm on its passenger car production quotas. Chairman J. A. Krug said, in part: "At the time these quotas were set it was recognized that it would be impossible to set quotas that would be satisfactory to all members of the industry. As anticipated, protests are being received from members of the industry who do not consider their quotas appropriate.

"I wish to make it clear that I have carefully reviewed all the facts and considerations leading to the assignment of the quotas and there will be no change in the quotas at this time. If the supply of materials and facilities becomes substantially easier or tighter, there will be a corresponding over-all revision of quotas."

Production quotas were assigned by WPB, on June 20, to individual companies as follows:

Company	July 1, 1945, to December 31, 1945	January 1, 1946, to March 31, 1946
General Motors Corp.	95,096	190,192
Chrysler Corp.	49,635	99,270
Ford Motor Co.	39,910	79,820
Studebaker Corp.	9,275	18,550
Hudson Motor Car Co.	8,000	13,602
Packard Motor Car Co.	8,000	12,118
Nash Kelvinator Corp.	8,000	11,550
Willys-Overland Motors, Inc.	8,000	8,000
Graham-Paige Motors Corp.	8000	8,000
Crosley Corp.	8,000	8,000
Total	241,916	449,102

The figures given in the table do not include any special type vehicles, such as taxicabs, ambulances or hearses. The quotas for such special vehicles have not yet been established.



TYPE "A" POWER BIT FOR

SAFER, FASTER, LOWER COST ASSEMBLY

AN EASY-TO-HIT TARGET. The visibility of CLUTCH HEAD'S wide roomy recess substitutes operator confidence for slow-down hesitation. Saves "breaking-in" period.

NO DRIVER CANTING. The Center Pivot column guides the bit directly into full-depth dead-center entry. Makes straight driving automatic.

NO "CHEWED-UP" HEADS to stop or slow up the line. Definite grip also protects manpower and material against slippage.

NO RIDE-OUT TENDENCY. With CLUTCH HEAD the driving contact of bit and recess walls is all-square. No "kick-out" as in tapered driving. Disposes of end pressure as a fatigue factor and slippage hazard.

EFFORTLESS DRIVING steps up speed for smoother, higher production. Checks out end-of-the-shift lagging.

DRIVE EXTRA THOUSANDS OF SCREWS with the rugged Type "A" Bit . . . without interruption for tool change.

NEW BIT LIFE IN 60 SECONDS. No back-to-the-factory shipment. Simple 60-second application of the end surface to a grinding wheel restores this bit to original efficiency.

THE COMMON SCREWDRIVER FOR

SIMPLIFIED FIELD SERVICING

THE ONLY MODERN SCREW on the market that is basically designed for operation with a common screwdriver.

FIELD SERVICE "HEADACHES" ELIMINATED. No time wasted hunting . special tools. No needless multiple tool expense.

WIDTH THE ONLY FACTOR. The only requirement is that the screwdriver blade be reasonably accurate in width. Thickness of the blade is secondary.

CUTS NON-OPERATING TIME. This simplified servicing expedites adjustments in the field to keep your product in consistent operation . . . an important selling point to users.

TYPE "A" HAND DRIVERS TOO. The same rugged bit is available for field service. While not essential, this bit has special advantages found in no other similar tool.

THE CLUTCH HEAD LOCK-ON enables service men to withdraw screws undamaged and saved for re-use, the reverse action securely locking the screw to the end of the Type "A" Bit. The same Lock-On feature operates in replacing screws, permitting of easy one-handed reaching to hard-to-get-at spots . . . frequently saving disassembling of surrounding units.

CLUTCH HEAD · SCREWS ·

Investigate what these exclusive CLUTCH HEAD *features mean to you in reconversion. Write for details, illustrated Brochure, package assortment of screws, and sample Type "A" Bit.*

UNITED SCREW AND BOLT CORPORATION

CHICAGO 8 CLEVELAND 2 NEW YORK 7

PUBLICATIONS

Pratt & Whitney has released a new catalog covering **Keilerflex Shaft Machines and Equipment.** It shows the machines themselves, the various handpieces, attachments and accessories which adapt them to so many different kinds of work.*

Bulletin No. MTM-45 has been issued by Detroit Tap & Tool Co. covering its improved **medium duty tapping machines.***

A new booklet, **Eureka Alloy Welding Electrodes,** published by Welding Equipment & Supply Co., describes Heat Resisting Alloy, Bronze, Copper, Copper-Nickel Alloy, Cast Iron and Drawalloy welding electrodes. Recommended uses and procedures for applications are also outlined.

DoAll has announced a correspondence course titled **Science of Measurement,** consisting of a group of eight lessons for industrial and vocational gage training programs. Detailed information may be obtained by writing to Continental Machines, Inc., 1301 Washington Avenue S., Minneapolis 4, Minn.

The Diamond Trading Co., Ltd., St. Andrew's House, 32-34 Holborn Viaduct, London E.C.1, has published a booklet, **Diamond Tool Patents for Machining Metals and Non-Metallic Substances.** The price per copy is 1/6d.

The George Scherr Co. has published a new 8-page folder, **Speed Surface Grinding Set-Ups.** The folder is well illustrated with actual applications of Magne-Blox products. Featured also is a new service offered by the company, the production of special sizes of Magne-Blox Parallels, V-Blocks and Angle Irons, as well as other shapes and forms to fit any type of magnetic chuck.*

3 High Strength Steels is the title of a new folder on the group of low-alloy, high-tensile steels produced by Republic Steel Corp. The 4-page folder, No. 434, gives general characteristics, chemical composition and physical properties of Republic Aldecor, Republic Cor-Ten and Republic Double Strength Steels.*

The Bristol Co. has announced the publication of a new 16-page bulletin describing its new **Microact and other Electric-Type Pyromaster Controllers.** The various types of controllers are illustrated and described, contact and load circuit wiring diagrams are given and typical applications are indicated.*

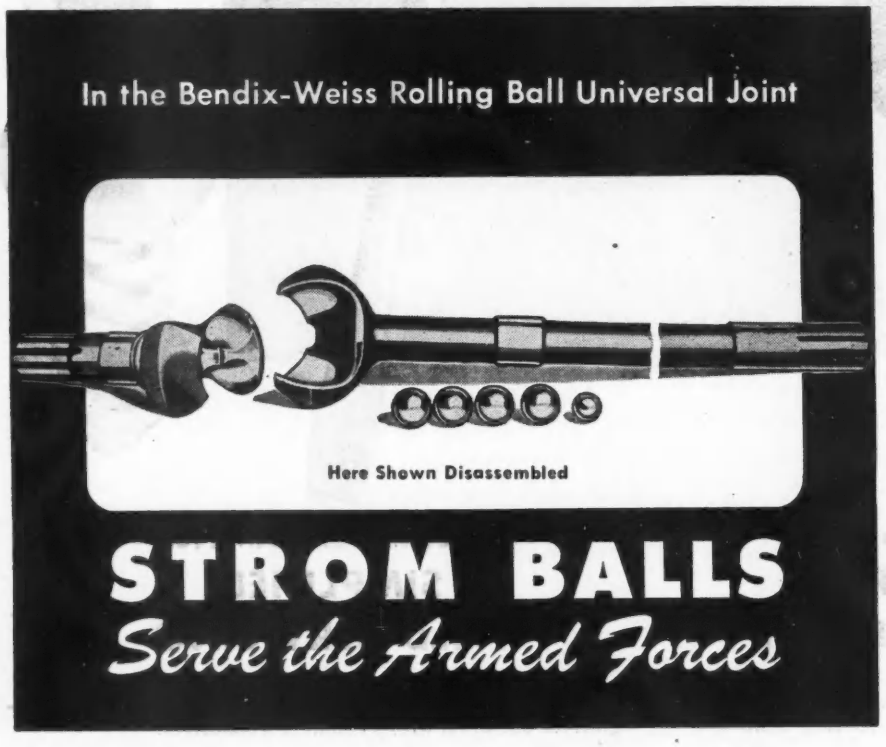
A new folder issued by Aircraft Standard Parts Co., describes and illustrates its line of **Aero Seal Worm Drive Hose Clamps** applicable in the automotive, aircraft, industrial and marine fields. The various types of clamps are described and a specifications table and price list are included.*

Foote Bros. Gear and Machine Corp. has released an Engineering Bulletin on **AQ (Aircraft Quality) gears.** It presents complete engineering data, comparative performance curves, design details, operating speeds and other data on this type gearing.*

The Weatherhead Co. has announced a new **Packing Catalog on T-Ring Packing,** a hydraulic packing designed to do away with extrusion damage.*

The Kropp Forge Co. has compiled a comprehensive list of forging terms with their correct definitions and published them in a 20-page illustrated booklet, **Glossary of Forging Terms.** Words and terms are defined as used in forging practice.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.



Here, in the Bendix-Weiss Constant Velocity Universal Joint, Strom Balls do their part in making military vehicles, from Jeeps to 14-ton Armored Cars, the efficient fighting equipment that they are. This is only one spot in our great war production effort where the high degree of perfection of Strom Balls serves industry, enabling it to provide the finest bearing equipment towards its great contribution to total victory. Strom Steel Ball Company, 1850 South 54th Avenue, Cicero 50, Ill.

Largest Independent and Exclusive Metal Ball Manufacturer

Strom BALLS Serve Industry

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

General Motors Corp., Fisher Body Div., resignation of **Lewis D. Crusoe,** divisional controller and **Claude A. Crusoe,** director of purchases of the division.

General Motors Corp., Electro-Motive Div., **Nelson C. Dezendorf,** director of Sales.

General Motors Corp., Chevrolet Motor Div.. **R. A. Johnson,** Mgr. Atlanta Assembly Plant; **D. S. Zimmerman, Mgr.** Norwood, Ohio, plant; **Floyd R. Lyness,** Mgr., Kansas City plant.

General Motors Corp., Chevrolet Motor Div., **John G. Wood,** Chief Engineer.

Bendix Aviation Corp., **William T. Gossett,** elected general counsel.

Chrysler Motor Corp., **W. Alton Jones,** president of Cities Service Co., elected a director.

Nash-Kelvinator Corp., Nash Motors Div., **N. F. Lawler,** Director of Advertising and Sales Promotion.

The Glenn L. Martin Co., **Peyton M. Magruder,** Director of Commercial Sales; **John H. Humpstone,** Asst. Director, Commercial Sales Group in chg. of export sales; **Howard Stanbury,** Sales engineer of Mars and other flying boats; **John E. Soonke,** Domestic Commercial Sales, and Mgr. of Special Projects.

Graham-Paige Motors Corp., **Harry D. Dodge,** Director of Foreign Sales.

Packard Motor Car Co., Buffalo Distribution Zone, **E. J. Platfoot,** Mgr.

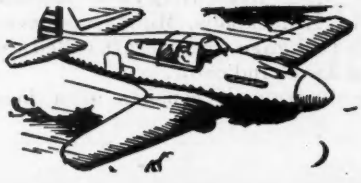
Pratt & Whitney, **Paul Mueller,** Mgr. of Engineering and Research.

General Motors Corp., A-C Spark Plug Div., **Richard E. Merrell,** Sales Promotion Mgr. of all AC replacement products; **Earl McGinnis,** Mgr. of National Account Sales; **Frank E. Ray,** Adv. Mgr.

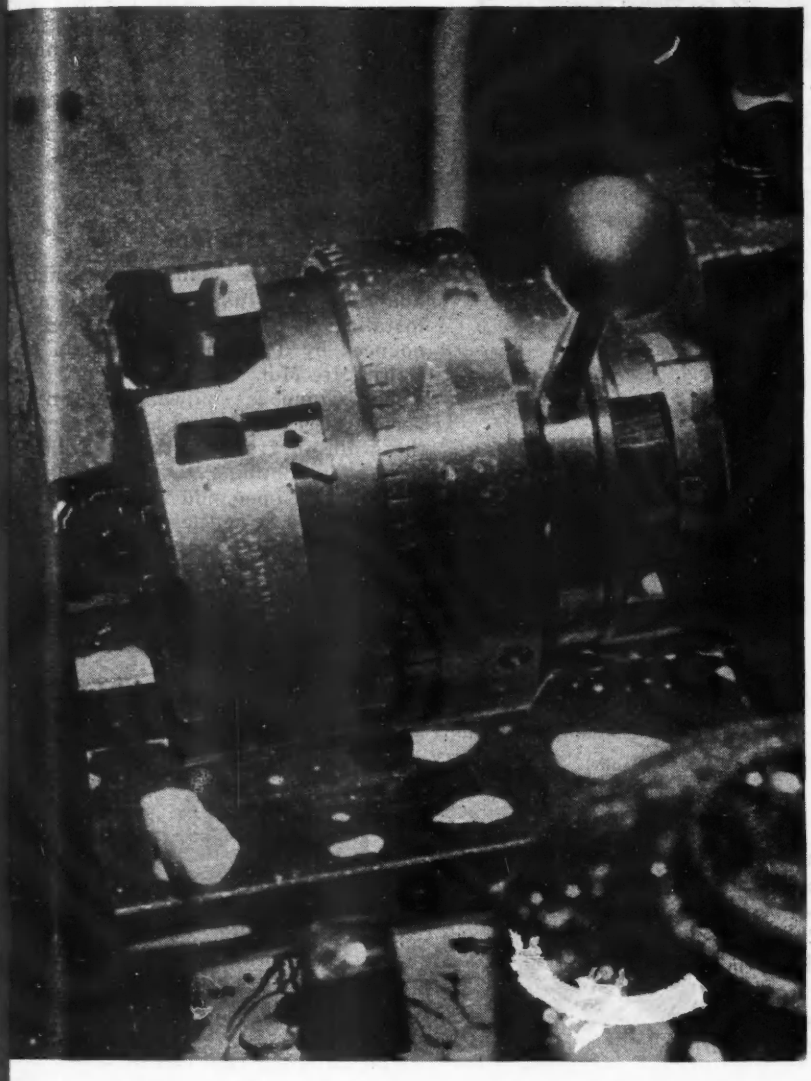
Young Radiator Co., Heat Transfer Prod-

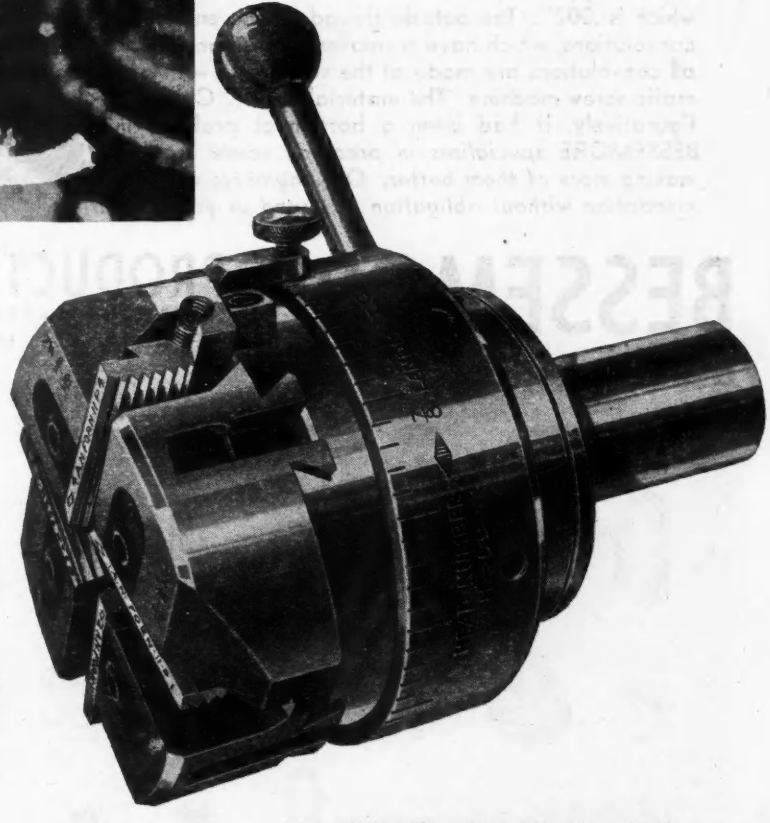
(*Turn to page 88, please*)

For Finer THREAD ACCURACY in AIRCRAFT



LANDMATIC HARDENED AND GROUND HEADS





Whether it be retractable landing gear assemblies, bomb bay doors, engine parts, fuel lines—or hundreds of other vital components where threads are the prime fastening or functional means—LANDMATIC Heads are producing threads for these parts to the close tolerance specifications that assure dependable operation.

LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

Write for Bulletin No. F-80

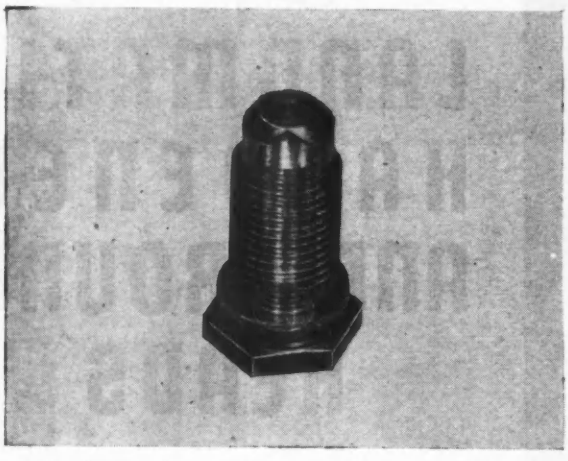
THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

New Products for Aircraft

Fuel Gage for Military Aircraft

The Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has developed a fuel gage for aircraft called the Liquid Level Indicator.

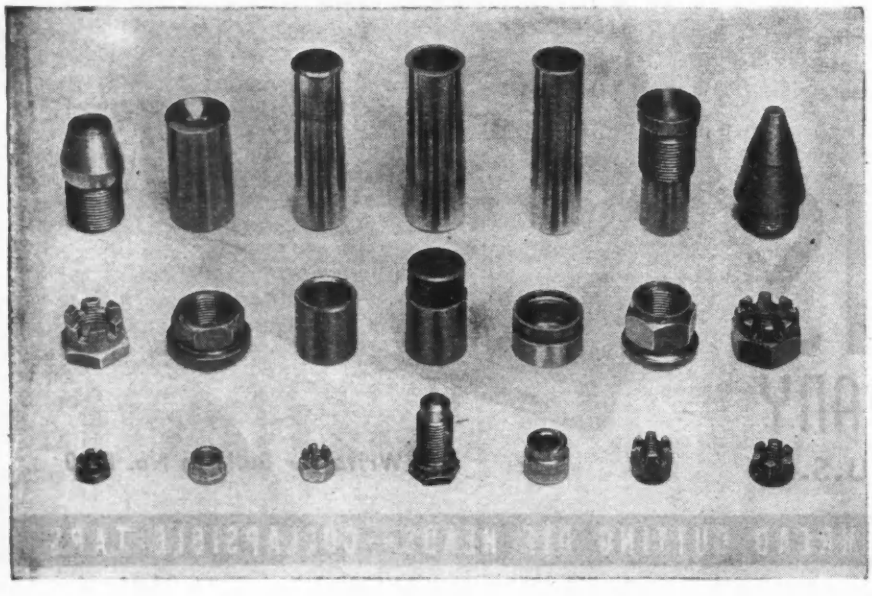
The instrument consists of a long tube which is mounted within the tank, and an electronic amplifier and meter mounted in the fuselage. The tube, looking like a section of pipe with two smaller pipes inside, is actually an electrical condenser. Called the "tank unit," the tube is constructed so that gasoline can flow inside it and between the two inside pipes. A minute electri current moves from one of these tube through the gasoline to the other tube The electrical capacitance of the gaso line, which changes with the height o the liquid within the tank unit, is mea sured electronically by the amplifie and a message is sent to the indicatin dial on the plane's instrument panel The meter itself is calibrated to rea in gallons.



This is one of the group of samples of ferrous and non-ferrous alloys, precision parts that have been made by BESSEMORE. On each of them the screw machine work was completed within 10 to 25 seconds and .002" tolerances maintained. The grinding work is held to .0001" (tenth).

A bushing (above) with an inside and outside thread, the concentricity of which is .002". The outside thread on the end of the bushing, has three convolutions, which have a smaller pitch than the other convolutions, but all convolutions are made at the same time with a single die on an automatic screw machine. The material is 18% Chromesteel . . . literally and figuratively, it had been a bottleneck problem in the war program. BESSEMORE *specializes in precision screw machine manufacture . . . making more of them better. Our engineers will be glad to make recommendation without obligation . . . send us your blueprints.*

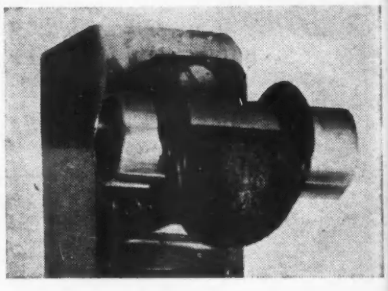
BESSEMORE PRODUCTS CO.
13243 EAST WARREN AVENUE
DETROIT 13, MICHIGAN



Clamp for Tube and Conduit Installations

A new type clamp, particularly adaptable for tube and conduit type installations of all kinds, has been announced by The Glenn L. Martin Co. Baltimore, Md.

The clamp is shaped after an inverted lateral "s" and is fastened to the wall or frame with an ordinary screw. The tubing to be fastened is placed in the open side of the curve and the clamping ring passes around the back of the base, over the top of the tubing and down the front where it is hooked under the curve at the front of the "s" to form a simple locking device.



Martin clamp

The clamping ring can be made of a high grade synthetic rubber or other elastic material. The rubber ring also serves as a "shock absorber" in eliminating vibration. If it is damaged and necessitates replacement, this can be accomplished without removing the clamp body. The clamp proper can be molded from a fabric base phenol fiber material or fabricated from formed sheet metal in any desired size.

Though the Martin Company has not started production in large quantities on the clamps at the present time, this work will get underway soon either through their own facilities or those of a licensee organization.

Electrical Actuators on Thunderbolt Dive Flaps

Quick and safe pull-outs from dives made at speeds at which modern fighting planes now operate presented problems requiring special work on dive flap installations. Performance of planes such as the P-47, and others, show that engineers have met this challenge by building compressibility

(*Turn to page* 56, *please*)

THERE MUST BE NO COMPROMISE WITH *Safety*

TODAY, America is depending on motor transportation as never before. Every load of war materials and equipment carried by big trailer outfits must get through — and *on time!* Delays due to accidents caused by ineffective brakes must be prevented — there should be no compromise with *safety!*

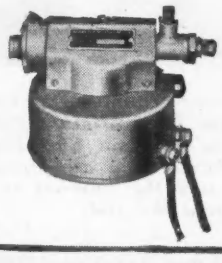
It is significant that 80% of all power-brake equipped trailing vehicles purchased by the government during this war — *have Warner Electric Brakes.* So take a tip from Uncle Sam — protect your drivers, your cargoes, and your trailer outfits — give them the EXTRA SAFETY of *Controlled Braking Power* — exclusive feature of Warner "Vari-Load" ELECTRIC Brakes. No matter what the weather, the driver can pre-set any and all brakes to fit BOTH load conditions and road conditions — thus keeping his train straightened out and under full control even when the going is slippery, and avoiding costly tie-ups due to damaged equipment.

On all future trailer purchases, specify Warner "Vari-Load" *Electric* Brakes — world-famous for safety, simplicity, and dependable, efficient, trouble-free performance.

WARNER ELECTRIC BRAKE MFG. CO.
BELOIT, WISCONSIN

Only a few flexible wires. Nothing to freeze or chatter — No complicated mechanisms.

WARNER
ELECTRIC BRAKES



NOW — Present Owners of Trailers with Warner Electric Brakes Can Have This New WARNER CONTROLLER

The new Warner Controller — simple and compact — synchronizes the hydraulic brakes on tractor with the Electric Brakes on trailer. The tractor's regular foot pedal operates both braking systems. This development creates smooth foot-touch tractor-trailer breaking under all conditions—eases driving strain—assures greater safety. Controller is easily and quickly fitted into hydraulic brake line. See your Warner dealer about changing over your present equipment.

FOOT PEDAL PRESSURE CONTROLS BRAKES ON BOTH TRACTOR AND TRAILER

In ordering your permanent mold aluminum castings from Acme you supply the blueprint, and Acme does the rest. Your casting is poured in an Acme mold that is made from an Acme pattern. You can rely upon an Acme mold to have proper gating and risering, permitting pouring at correct temperatures. Acme's centralized responsibility is particularly important in permanent mold work, where one mold may affect the quality of thousands of castings.

Acme made tools and patterns even before it made castings. And today, Acme engineering experience unites with advanced foundry practice to give you the finest possible results. For permanent mold castings with finer grain, greater strength, and maximum dimensional accuracy—and machined ready for assembly—secure the facts on Acme Castings today. Recommendations and quotations submitted promptly.

PATTERN MAKING
Backed by a Quarter Century of Experience

MAKING THE MOLD
Controlled by Advanced Engineering Standards

POURING THE CASTING
with Laboratory-Tested Alloys

CASTINGS FINISHED
to Exact Dimensions Ready for Assembly

ACME *Aluminum Alloys, Inc.*
Formerly Acme Pattern & Tool Co., Inc.
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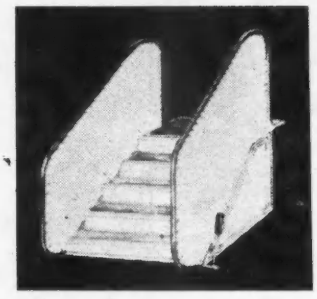
Passenger Loading Platform



This passenger loading platform is made by Aircraft Mechanics, Inc., Colorado Springs, Colo., for Continental and other airlines. It combines durability with good appearance, and the cost is such that it can be used on both small and large air terminals. An additional feature is the ease with which this loading platform may be handled.

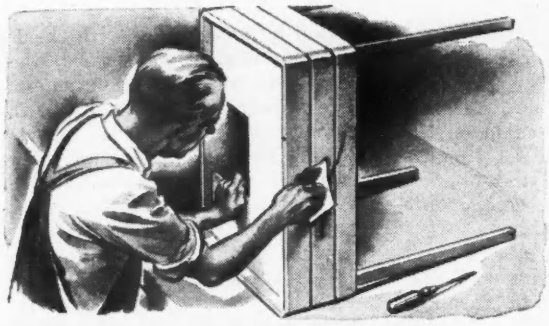
(*Continued from page* 52)

dive flap installations permitting quick pull-outs, at high Mach numbers, while the plane is still at high altitude. The diving momentum which ordinarily results when compressibility shock occurs on the wing is offset by the dive flap action.

This installation includes a dive flap under each of the P-47 wings, each flap hinged at the forward edge. The installation consists of two Lear rotary actuators which are connected to the flaps by means of levers and rods, Lear flexible shafting, Lear angle drives, Lear bulkhead connectors, limit switches to control the extent of travel of the dive flap, a relay and a circuit protector, connected with the switch in the cockpit. There is a Lear 206B actuator in each wing. The actuators are interconnected by flexible shafting, through angle drives and couplings. interconnection provides synchronization and for emergency power so that in case one motor is damaged by gun fire the other can drive both flaps.

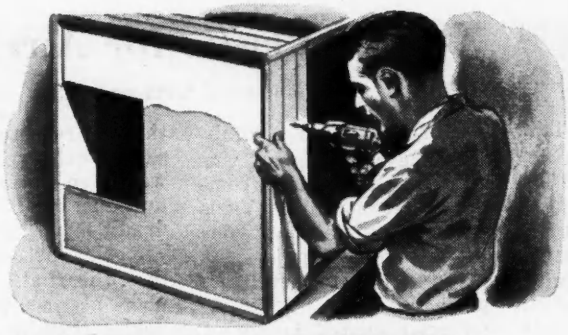
Scale Counts Parts by Direct Dial Reading

This scale to count parts by direct reading has been originated by J. H. Keeney & Co., Chicago, Ill. Parts to be counted are placed on the scale and the number is read directly from the dial.



SHUTS OUT SLIP-UPS!

Assembling baby furniture was mighty slow work with slotted screws, one manufacturer found. Too many scratches to refinish – scratches caused by driver skids. So to pick up production he switched to Phillips Screws...



FRIENDLY TO PROFITS!

... out went burred heads and driver skids and slant driven screws. Out went slow-as-molasses hand driving. In came power driving – and with it, savings in time and materials that sliced a big chunk off assembly costs.

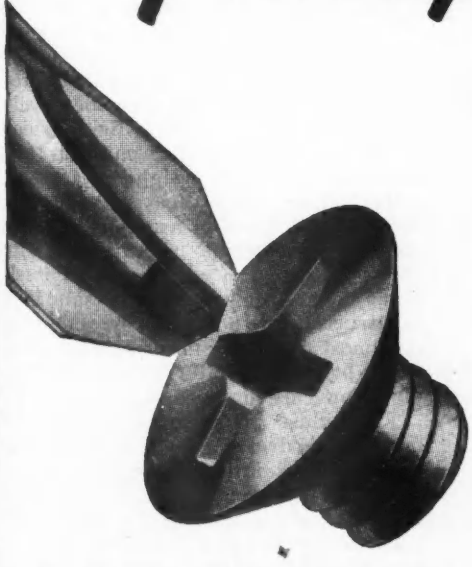
LONG ON SAFETY!

By making it stronger and more rigid, and by banishing dangerous burrs, Phillips Screws made this furniture safer for the kids. And your designers will find they do the same things for your product – whether it's tiny as a hearing aid or hefty as a harvester!

TOUGH ON COMPETITION!

Because of the ornamental design of the recess, Phillips Recessed Head Screws impart a "quality look" to any product. They give you a burr-free, blemish-free job that tells prospects you're on *your* toes – and warns competitors to watch out for *theirs!*

It's Phillips ... the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

... It's the exact pitch of the angles that eliminates driver skids.

... It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

... It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS Recessed Head SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

Glass Plastic for Aircraft

(*Continued from page* 33)

2. The prefabricated honeycomb which is flexible like crepe paper, was placed on top of the fiber-cloth completely covering the section area. Various fitting were set in to take out concentrated loads—attachment points for joining the plastic section to metal section of the fuselage.

3. Additional resin coated layers of fiber-glass cloth were laid over the core material to form the inner face of the sandwich.

4. A rubber blanket was placed over this entire assembly and sealed on the edges with a pressure seal. A vacuum was then drawn between the blanket and the mold to hold the components firmly in position while baking.

5. The process was repeated to get the other half of the fuselage. Glass-fiber ply cemented the two fuselage halves together.

Engineers of the Aircraft Laboratory, Air Technical Service Command, Wright Field, who initiated the development of this all-glass fuselage section in cooperation with the Plasko Division, Libby-Owens Ford Glass Co. point out that construction methods were purely experimental and that the methods used are not directly applicable to mass production. These researchers assert that baking time can be reduced from a matter of hours to a matter of minutes; that further experience will make possible molding the whole fuselage in one operation.

According to Colonel Paul H. Kemmer, Chief of the Aircraft and Physical Requirements Subdivision, Air Technical Service Command, "Molds, ovens and other fabricating tools used in producing plastic airplanes should cost less than dies, presses, hammers and other special equipment needed to build all-metal aircraft. Subassemblies or assemblies with many of the required design features molded integrally should reduce the multitude of separate parts and operations involved in current manufacturing."

In addition to saving in fabrication time, the glass construction appears to provide such further advantages as greater plane speeds, less buffeting and vibration. Its glass-smooth surface permits undisturbed airflow—an essential factor to high speeds that even flush-riveting in conventional all-metal construction has not fully achieved. This indicates that the glass plastic would be desirable on high-performance airplanes where even the slighest surface drag interference can retard a plane's top speed by 10 to 25 mph. One pursuit airplane, it is known, lost 23 mph in high-speed performance tests because its exterior skin was not perfectly smooth.

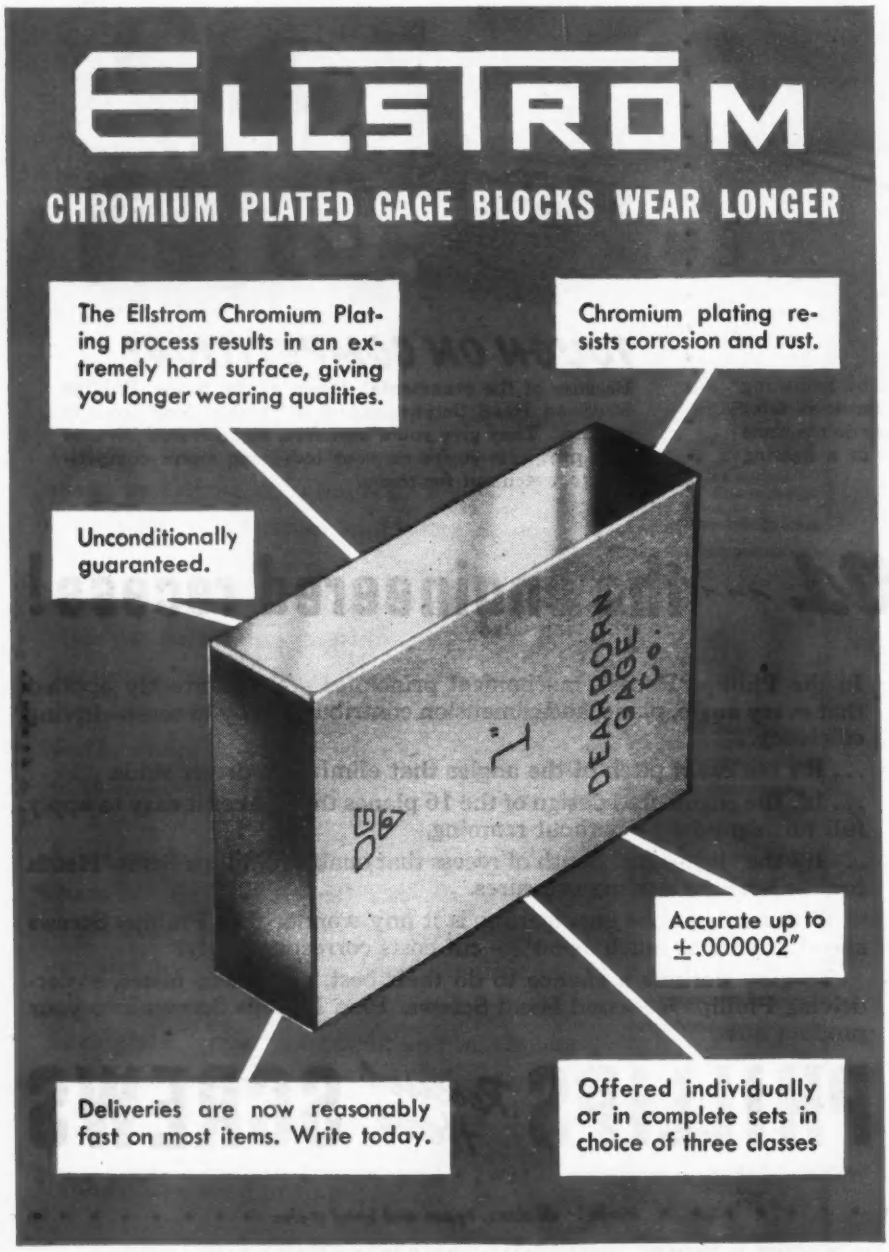
The British Mosquito—a plywood airplane whose structure is a series of laminated wood layers—had 30 mph added to its speed because of its lacquered and waxed surface. A polished surface of equal smoothness can be produced with the new glass-laminated material. Its coloring can be ready mixed with the resin filling, which eliminates the need for painting and thus cuts down on weight factors.

The glass-plastic also serves as a cabin sound proofer as well as basic structural material. Because of its porous nature the core material itself tends to absorb sound. The sandwich construction with its honeycomb core is almost identical in principle to all sound-proofing materials. Likewise, vibrations are damped.

Fiber-glass construction is also a mechanics' dream when it comes to repairability. Patches are put on the same as you would vulcanize a tire. The laminate is used in a semi-flexible state to patch up a hole and then is hardened to proper form under an infra-red lamp or natural sunshine.

Unlike wood structures or plywood airplanes, the glass laminate does not expand or contract under specific moisture conditions and, therefore, can be used in any climate. It also has no variation in grain or density which is

(*Turn to page* 60, *please*)


ELLSTROM
CHROMIUM PLATED GAGE BLOCKS WEAR LONGER
The Ellstrom Chromium Plating process results in an extremely hard surface, giving you longer wearing qualities.
Chromium plating resists corrosion and rust.
Unconditionally guaranteed.
Accurate up to ±.000002"
Deliveries are now reasonably fast on most items. Write today.
Offered individually or in complete sets in choice of three classes
DEARBORN GAGE CO.

DEARBORN GAGE CO. 2037 BEECH STREET DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks

Have you seen the new day coming?

Even in the pre-dawn darkness of war there are signs that it is on the way. . . . It *can* be the greatest day the world has ever known.

Already men, materials and American ideals have penetrated to the last wildernesses of the earth. There's a trans-Atlantic flight every 13 minutes of the day and night . . . 160,000 miles of air routes being flown by American transport planes . . . our air strength is double that of the rest of the world combined . . . our manufacturing productivity half of the world's total capacity. We have what it takes to force prosperity and to *enforce* peace.

We at Bryant feel that we're part of the new day that's coming. Our record in war links us with great production achievements, from the millionths-of-an-inch precision in the modern airplane engine to the millions of things that we'll help to produce more simply, faster, for less. We urge you to call us in now!

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

GET SET NOW!

● Force measuring and weighing apparatus has taken day-and-night punishment in this war. Even the best of the war-made equipment will not give prewar performance, in durability and continued accuracy.

Yet invisible losses due to inaccurate control equipment can seriously affect costs, quality standards and profits.

We can help you in planning for weighing, counting, force-measuring, batching, testing and similar control operations. You can save time and loss later if you get set on these matters now. Write for timely information pertinent to your industry. Toledo Scale Company, Industrial Division, Toledo 12, Ohio.

TOLEDO

HEADQUARTERS FOR

SCALES

a constant variable in woods. This insures uniformity in construction and strength reliability.

Comparative strength figures show that during a destruction test of a glass-reinforced sandwich fuselage section which weighed 75 pounds, the structure took a load of 2540 pounds, or 180 per cent of its design load, before breakage of a fitting bolt. The same test with an all-metal fuselage of similar design weighing 70 pounds caused failure with a 1550-pound load. A birch fuselage of plywood construction and weighing 86 pounds failed under a load of 1580 pounds. Conclusively, the Army Air Forces has a new aircraft structural material.

Already the glass-plastic suggests use for fabricating whole sections of large airplanes to accomodate radar installations which require non-metallic housings. Construction of entire fuselage sections rather than protruding domes would greatly increase speed of some bombardment type aircraft. Under gunfire tests the all-glass fuselage stands up well. Fifty caliber shells pierced the half-inch thick material without shattering it, left clean holes which would easily lend themselves to patching. High explosive bullets failed to detonate because of the material's low density.

Sulzer Diesels

(*Continued from page* 22)

a 4¾ in. stroke for each piston, is also a multiple-purpose engine used in trucks, tractors, boats, generating sets, etc. It is built with 2, 3 or 4 cylinders, with ratings of 60 to 135 hp. Maximum ratings at 1500 rpm in the accompanying specification table can be increased by 15 per cent for momentary overload. A 6-cylinder version for large semi-trailer trucks is in the experimental stage. Bmep of these engines is 84 psi (corresponding to 168 psi for a four-stroke). Although the crankshaft speed is 1000-1500 rpm, the mean piston speed is below 1200 fpm. The fuel consumption of 0.42 lb per bhp-hr at full load is excellent for an engine of this type. In some instances in Europe, where this Diesel has replaced gasoline engines, it has paid for its cost, including installation, in less than 300 days.

Sulzer has built larger engines of this same type. Some railcar engines of 400 and 600 bhp, bore 5½ in. are in service. A 7½ in. bore, four-cylinder engine with a supercharging pressure of 28.5 psi and bmep of 170 psi has been displayed. The 7½ in. bore size is the maximum for this type of Sulzer engine, primarily on account of the increasing mass of reciprocating parts such as rocker arms, for the larger high-speed two-stroke engines, also supercharged, are of vertically opposed-piston type, with two crankshafts interconnected through gears.

Electrically..

TO SPEED RECONVERSION

USE THIS

3-way Maintenance Service

THAT HAS PROVED ITS VALUE IN SCORES OF WAR PLANTS

Westinghouse Maintenance Service is a nationwide service... as close as your telephone. It brings you faster, better, longer-lasting electrical repairs to keep your equipment at peak productive efficiency, plus a consulting service by experienced engineers.

If electrical machines or apparatus in your plant need reconditioning or rebuilding—or if you wish to speed reconversion—this 3-way Westinghouse Maintenance Service is prepared to help with your problem.

Back of this service are years of experience in handling electrical and steam equipment repairs for practically every industry. This experience is supplemented by a continuous program of research in one of the world's largest laboratories to find new techniques and better materials for maintenance work. When Westinghouse handles your repairs, you benefit from a wealth of practical experience, plus the latest developments of science.

For full information, call your nearest Westinghouse office. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-96003

FOR COMPLETE MAINTENANCE SERVICE

In addition to experienced engineers, factory-trained repairmen and complete repair plant facilities, Westinghouse has special machines and test equipment, plus genuine Westinghouse Renewal Parts . . . all available for your electrical and steam repairs.

For prompt service, phone your nearest Westinghouse office and ask for "Maintenance".

KEEP YOUR ELECTRICAL EQUIPMENT UP TO PAR WITH...

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Maintenance Service

REPAIRS • PARTS • ENGINEERING

Technical Standards for Welding Electrodes

The Editor,
Automotive and Aviation Industries,
Chestnut & 56th Streets,
Philadelphia, Pa.
Dear Sir:

Industry in general, and the welding industry in particular, are and have been greatly handicapped by the lack of a real technical standard covering electrodes. True it is, there has been in existence for some years a so-called standard which actually might be termed a "buyers' guide." This is known as "Tentative Specifications for Iron and Steel Arc Welding Electrodes" published by the AWS. However, even in this long and complicated "buyers' guide" there are so many discrepancies with ambiguous and contradictory statements that it is rendered entirely unsatisfactory. Let me cite a few examples.

To qualify any electrode for any classification, the tests are so complicated and so costly as to render them useless in manufacturing practice. They are too costly to be repeated periodically as a check on manufacturing standards.

Tests are required on all sizes o 5/32 in. and above, but note—no test are required on ⅛ in. and smaller s why have tests on *each* larger size?

A manufacturer cannot use the sam electrode for two or more classifica tions; this in spite of the fact that th ideal electrode, of course, is one whic would fulfill all classifications.

Then there are specifications as t the electrical resistance of the coating which certainly has nothing to do wit the performance of the electrode.

Also it says: "The coating shall no have scabs, blisters, abnormal pock marks, bruises, or other surface de fects that shall be injurious." Jus what is injurious?

These are only a few of the idiosyn crasies of this "buyers' guide." There fore, it can readily be seen that what i needed is a simple, easily understand able standard which would enable a manufacturer to manufacture to such standards consistently and would en able the purchaser to readily and easily test the electrodes if he wished to do so, to see if the manufacturer was con forming to the standards.

Since there is no need for a weld stronger or better than the material t be welded, I suggest for mild steel which covers 90 per cent of the re quirements, a simple standard, some thing as follows:

The electrode shall be of such characteristics that it will withstand the following tests to be made any time a buyer might desire:

(a) A weld made in ⅜ in. or ½ in. plate of mild steel, planed to the same thickness as the parent metal must break outside of the weld when pulled in a standard tension machine.

(b) On a section from the same plate mentioned in (a), welds to be bent in any way desired and elonga tion of 25 per cent in the outside fibers must show no fracture.

It is quite evident that an electrode which will perform as indicated in these two tests will give a weld equal in physical qualities to the plate. With such a weld, obviously the matter of porosity is of no consequence. How ever, if it should be desired to cover the question of porosity, a simple test could be made as follows:

A fracture shall be made through the weld. On a straight line through the fractured weld there shall be voids of no more than 5 per cent cumulatively.

There is no question but that an electrode which will withstand the above very simple tests will be satis factory in welding mild steel, so why complicate matters. It seems to me that this is a question to which the Filler Metal Committee of the Ameri can Welding Society, 33 W. 39th Street New York City, should give proper attention.

Very truly yours,
The Lincoln Electric Company,
J. F. Lincoln, President

ARE YOU CONSIDERING THE USE OF

ALUMINUM

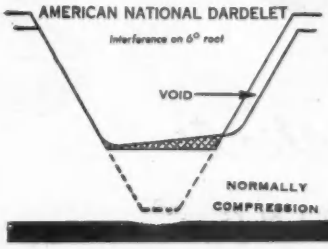
OR

MAGNESIUM

IN YOUR NEW PRODUCT?

AMERICAN NATIONAL THREAD

AMERICAN NATIONAL DARDELET THREAD



When the original "V" form of thread came into use these metals were unknown in industry.

The use of the new American National Dardelet is of particular advantage in these lighter metals.

- Does not gall in assembly.
- Does not fret from lateral motion.
- Does not require selective fits.
- Does not loosen and back out.
- May be sealed if desired.
- Stronger in tension and torsion.
- Materially increases fatigue life.

Contact is made on a wide 60° root rather than on flanks. Gaging, therefore, is simplified.

In production National taps and gages may be used without change. Threading tools and snap gages require minor changes only.

DARDELET THREADLOCK CORPORATION
2832 E. GRAND BLVD. • DETROIT 11, MICHIGAN

What Sweden Did

(*Continued from page* 23)

From this crude, the Svenska Skifferoljefabriken derives not only heavier fuels (i.e., fuel oil for steam-boilers and the like) but also automotive gasoline, kerosene and Diesel fuel. These fuels have proved to be very good, the worst thing about them being their unsuitability for storage in tanks for a long time.

The Tar-Oils

Tar-oils derived from wood, have been put to work as a source of both engine fuels and lubricants. The tar best suited for engine fuel is that extracted from pinewood. A company founded by the government, the Governmental Forest Industries, started production of pinewood tar some time ago. The output of this company reached a point above demands, but the surplus was subsequently consumed by the fishing boats.

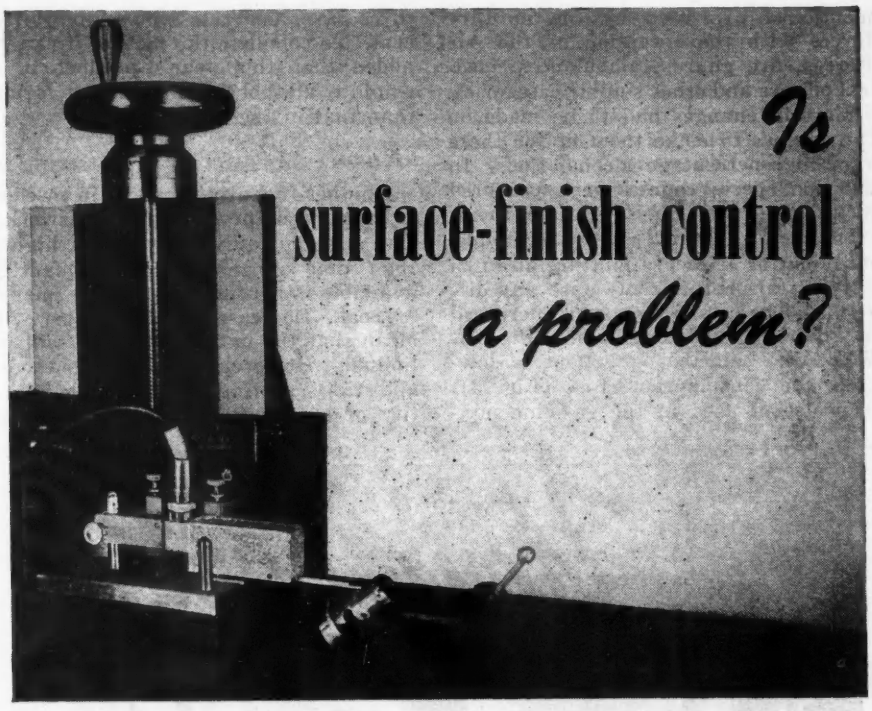
Tar-oils for engines are used for units with an output of 25 hp per cylinder, or greater. Smaller engines generally cause trouble when driven by tar fuel because of the coke and pitch formed in the cylinders. In this connection, technicians have provided a solvent which is mixed with the fuel or is introduced into the cylinder by other means.

Recently, the Governmental Board of Fuels has been experimenting with tar-oil fuels for farm tractors. However, the rotational speed of these engines is so high, that the regular combustion period is too short when the conventional tar-oils are burned in them. Experimentation is being carried on in these engines with results to date indicating that a solution is possible. Success in this respect would mean that the largest part of the kerosene for farm tractor engines can be eventually replaced by tar derivatives. Some derivatives obtained by distillating stub-tar have been utilized as engine fuels by mixing with ethyl alcohol, which decreases the viscosity of the tar.

Alcohol plus Gasoline

In spite of all experiments on substitutes, there are certain types of engines which cannot be driven by producer gas, charcoal or any of the tar-oil products. Therefore, the Swedish Board of Fuels has been forced to release a portion of the stored mineral fuel but has mixed it with alcohol. July 1, 1942, the Board decreed that engines of the type mentioned be driven by two standardized fuels, Motyl 50 and Motyl 85. The former contains 50 per cent alcohol while the latter contains 85 per cent alcohol and only 15 per cent gasoline. But, why not use alcohol exclusively? The answer is that the alcohol has affected the engines badly; *i.e.*, it causes trouble because of the acetic acid present with its use. The two fuels

(*Turn to page* 68, *please*)



Is surface-finish control *a problem?*

WAR PRODUCTION experience has shown that the measurement of surface roughness is a practical necessity in any program of quality control. By enabling the practical measurement of surface roughness, the Profilometer has helped to round out this aspect of quality control in four ways:

1. It has enabled necessary research into the effect of surface roughness on the performance of parts.
2. It has enabled the use of a simple convenient symbol for the designation of the desired surface roughness on blueprints and specifications.
3. It has provided a quick and accurate means of checking production setups to determine the finish of parts coming from the machine.
4. It has enabled inspection departments to inspect quickly and accurately a run of parts for the surface roughness specified.

Military requirements for performance have resulted in surface roughness specifications being set for an infinite number of parts varying widely in their shapes, roughnesses, and materials. So that accurate measurements can be taken on this wide variety of parts, Physicists Research Company has developed a number of accessories for the standard Profilometer and maintains a program of continuing research and development in this field.

If you are now working on surface-roughness control or on post-war production plans, you will be interested in talking with one of our field engineers. Our representative would be glad to call at your plant to discuss the Profilometer and to demonstrate it on the work you are now doing. This demonstration call will incur no obligation on your part and may be arranged by addressing Physicists Research Company, 343 South Main Street, Ann Arbor, Michigan.

Pictured above: The Type KA Tracer and Type A Piloting Fixture for use on very smooth surfaces and for measuring the surface in holes and slots as small as 1 / 16 inch ID.

Profilometer Catalog available on request.

PHYSICISTS RESEARCH COMPANY

343 SOUTH MAIN STREET · ANN ARBOR, MICHIGAN

mentioned are used by the military forces with the exception of the Air Forces, fire guards, ambulances, medical officers and other similar categories.

Certain changes had to be made on the engines to make them fit for these very high-percentage alcohol fuels. In addition, special courses were sponsored by the Board of Fuels in order to inform car owners of the new technique. As a matter of fact, a mixture up to 25 per cent alcohol did not cause any difficulty. The octane number is increased by adding alcohol to gasoline (Fig. 2). While the calorific equivalent is lowered, the consumption rises (Fig. 3). The alcohol used in the gasoline mixtures have, as a rule a purity of 95 per cent. To complete the picture it can be added that this year's production of sulphite alcohol is three times larger than that of the prewar years.

Benzol

Another fuel also produced in Sweden is benzol, a by-product of the gasworks. The calorific equivalent is even higher than that of gasoline. The quantity available is dependent upon the import of coal. Decreased coal supplies will mean that the output of benzol will be limited. However, Sweden has been, and still is, getting a considerable quantity of benzol. By contracts with the gasworks and by establishing clarification plants (built by the Governme the output is kept at a fairly-high le Very good results have been obtai by mixing benzol with gasoline.

Mineral oils

It was previously mentioned t the gasoline stored in Sweden at outbreak of the war and the sm quantities imported have been reser for military purposes; but a large nu ber of the army vehicles have b converted to burn charcoal or wood instead of gasoline.

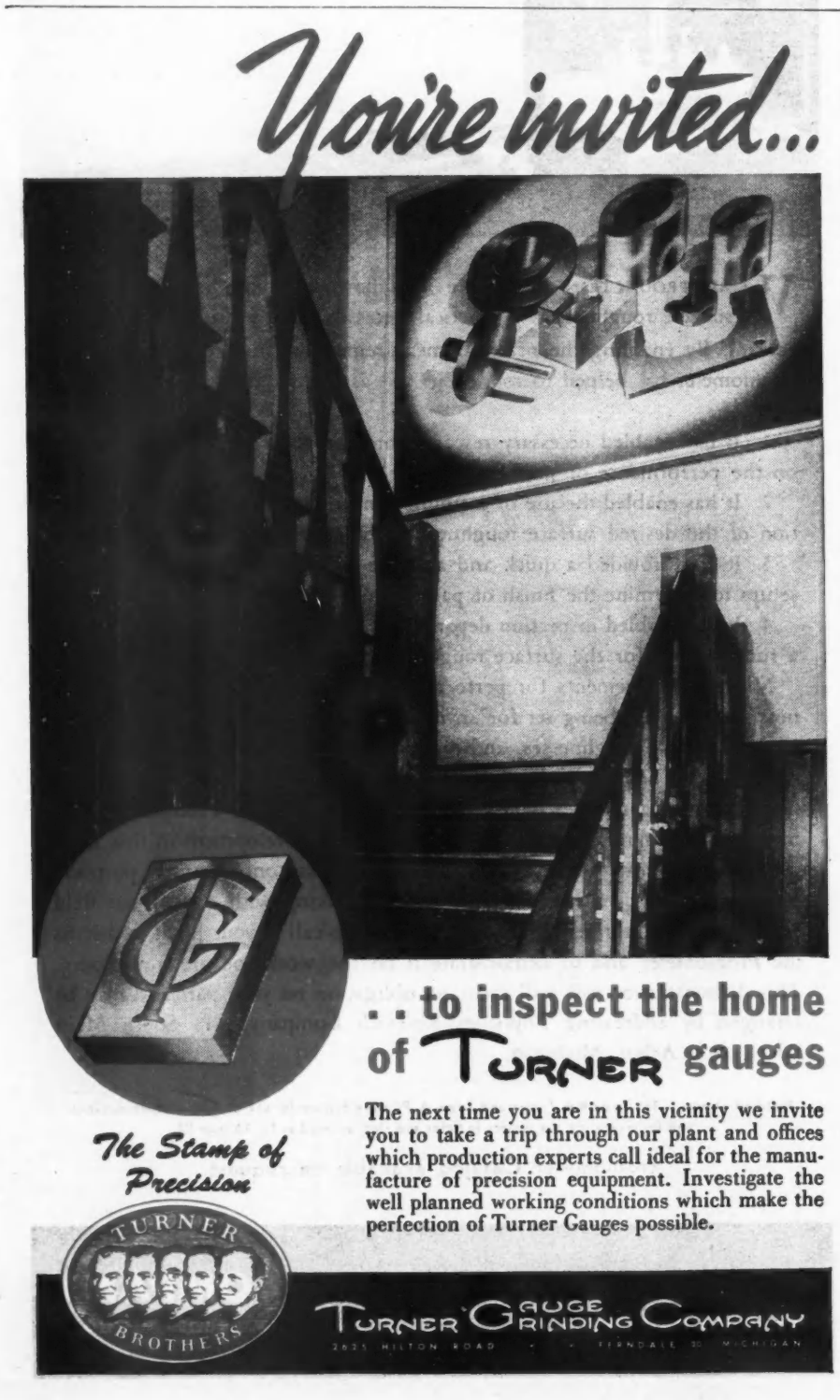
One of the questions arising early the war was the following: Could gasoline be stored for a long time? was considered that storage time sho not exceed a year. The Board of Fu immediately started experiments on called inhibitors which were disc tinued when some import supplies came available.

The Lubrication Problem

Lubricants caused the same short troubles at the outbreak of the war did fuels, if not more so. During war, Sweden's consumption of lubric ing oils has been cut down to 50 cent of pre-war consumption. This affected not only private-car traffic, also the traffic necessary to keep food supplies and transports of dif ent kinds running, all of which h been subject to rationing. Private torists get only enough lubricating (about two gal) to drive 3100 mile year. Additional rations are allow for important uses. The ration lubricants given to the farmers is ba on the so-called "tractor area." total area of cultivated soil is decrea by the part tilled by horse-driven chinery; the remainder forms the tr tor area. The fishermen, depending tirely upon the gasoline and lubric allowances for their living, get a qu tity of about 116 gal. a year, vary with the type of engine they have.

Lubricant Conservation and Substitutes

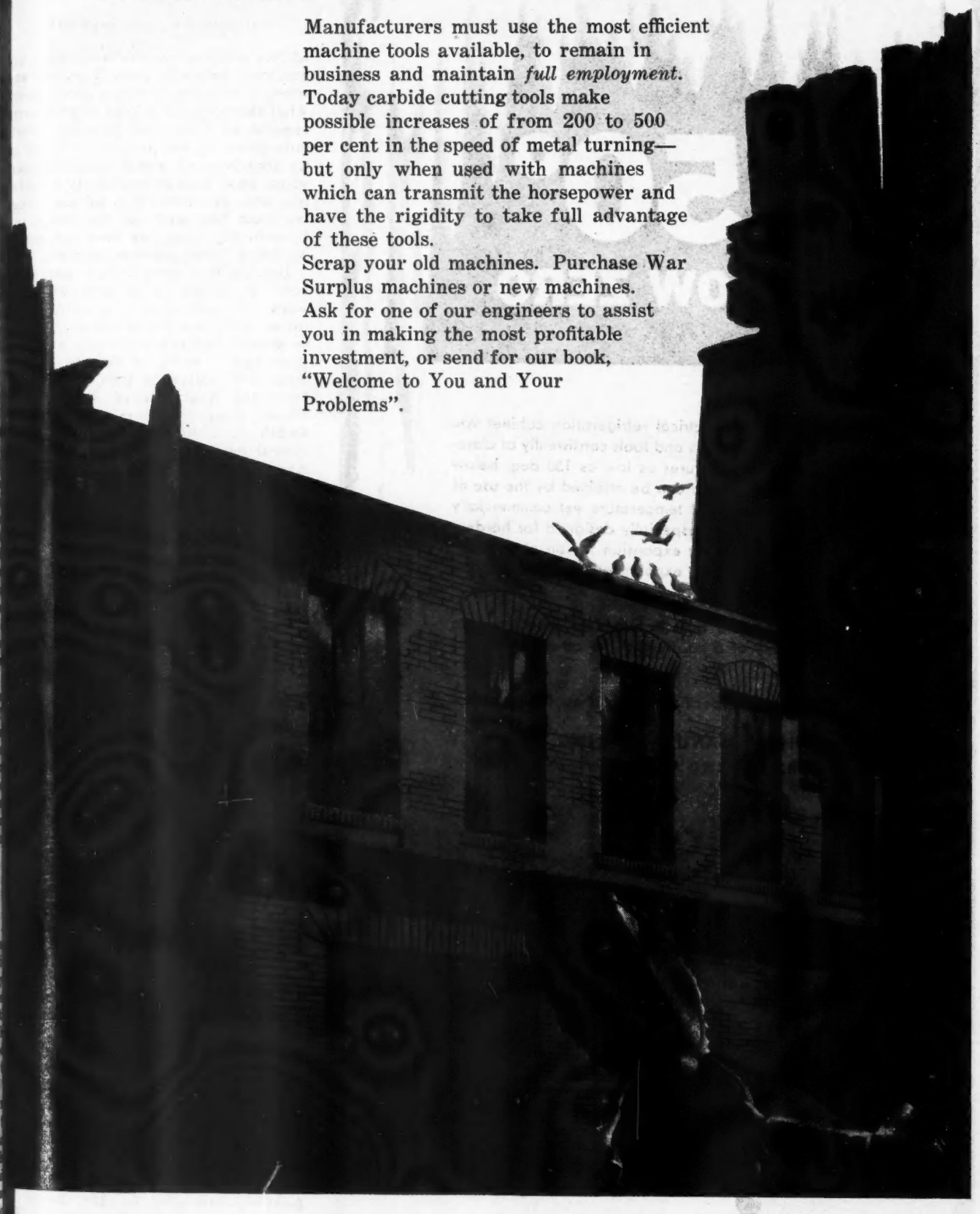
Along with the experiments on methods to produce lubricants, Swed industrialists have contributed larg to the saving of oil. Mills and wo shops have tried, on their own ini tive, to reduce consumption. This been accomplished by various metho for instance, they have converted power-transmission from shaftings individual machines on lathes, bori machines and cutters. Because of difficulties and costs, not every fact owner could accomplish this, but t have tried in other ways to dimin the consumption. Clarification reclamation of used oils have been d on a large scale. Even with all th efforts, the wheels of Swedish indus could not have been kept function had not the engineers and scientists Sweden been able to provide substitu for petroleum fuels and lubricants.


You're invited...
. . to inspect the home of TURNER gauges
The next time you are in this vicinity we invite you to take a trip through our plant and offices which production experts call ideal for the manufacture of precision equipment. Investigate the well planned working conditions which make the perfection of Turner Gauges possible.
The Stamp of Precision
TURNER BROTHERS
TURNER GAUGE GRINDING COMPANY

COSTS WILL MAKE THE DIFFERENCE

Manufacturers must use the most efficient machine tools available, to remain in business and maintain *full employment.* Today carbide cutting tools make possible increases of from 200 to 500 per cent in the speed of metal turning—but only when used with machines which can transmit the horsepower and have the rigidity to take full advantage of these tools.

Scrap your old machines. Purchase War Surplus machines or new machines. Ask for one of our engineers to assist you in making the most profitable investment, or send for our book, "Welcome to You and Your Problems".



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150°
BELOW ZERO

In a KOLD-HOLD electrical refrigeration cabinet you can process metal parts and tools consistently at closely controlled temperatures as low as 150 deg. below zero—much lower than can be attained by the use of dry ice and the lowest temperature yet commercially available. This unit is especially designed for hardening steel tools, making expansion fits on close tolerance assemblies, for experimental work, and for product research.

These cabinets are built in two sizes, one having a work capacity of 5 cu. ft. and the other a capacity of 11 cu. ft.

Write for further specifications and quotation.

KOLD-HOLD MANUFACTURING COMPANY
453 NORTH GRAND AVE. • LANSING 4, MICH.

KOLD-HOLD

Prices, Profits and Production

(*Continued from page* 15)

of jobs supplied by business. They ar and must be useful jobs. They are al must be jobs that produce goods wort what they cost. The kind of prosperit created by productive jobs in privat enterprise is real prosperity—built o an abundance of useful goods and se vices. That kind of prosperity require markets. However, with all the thing we want and with all the money w have to buy them, we need not worr too much about postwar markets.

But business needs more than mar kets. It needs funds with which t work. It must be able to provide fa tories, and tools, and machines; it mus be able to buy raw materials and sup plies and it must be able to pay it wage bill before it gets the incom from the final sale of its product Those things cost money. It co $6,215 in 1940 to provide just on typical job in manufacturing industry Even though, manufacturers provid only about one-fourth of all the job the capital needs in manufacturin alone add up to quite a figure, whe we talk in terms of 50 or 60 millio jobs!

It is true that we already have vast accumulation of productive a sets. But if we are going to have mor jobs than ever before, we are going t need more capital than ever befor That needed capital certainly ought t come from private savers, with the $116 billions of wartime savings. I ought not to come from the Gover ment, with its $250 billions of wartim debt.

Our private citizens have plenty money to finance the capital expansio necessary to provide the needed pos war jobs. They will invest it, if the have a fair prospect of earning profit to compensate for the risks the take. And if we want to preserve th American system, Government po cies must allow them that opportuni for profit.

Profit is the reward we give tho who take the risks of providing jo and goods for others. It is the pa ment we make for our factories, a machines, and equipment, and workin funds. It supplies the reserve for r habilitation, improvement, and exte sion of existing plants and productio facilities. If ft is good to have produ tive assets, it is good to pay the pri necessary for their creation and mai tenance. A wise Government will ce tainly recognize that fact.—*From statement to the House Committee Banking presented by Mr. Davis Chairman, N. A. M. Committee on I flation Control.*

Buy More Bonds

OF COURSE, YOU WILL WANT TO BE "IN-THE-KNOW" ON *Power Boosters*

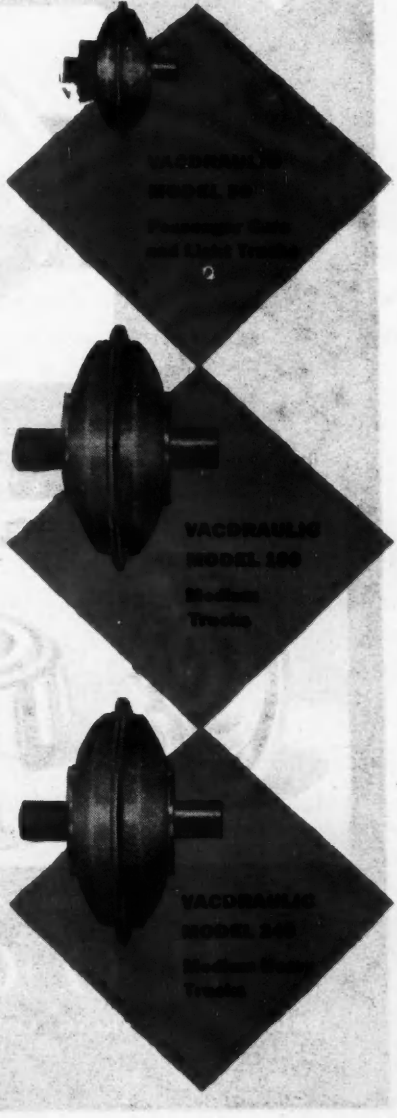
You know, of course, that Brake Power Boosters are a "red hot" subject.

You know that we must — we will have better brakes — and soon! Safety demands a considerable step-up in stopability.

You will want to know all about the simplified design of Vacdraulic, featuring the elimination of action lag, few moving parts and other engineering advances. It is an automotive development which will interest you.

Whether factory engineer, maintenance supervisor, commercial truck owner, independent mechanic, school bus builder, car or truck dealer — you will find the information we have prepared helpful.

Be sure to send for this informative material.



VACDRAULIC THE BRAKE POWER BOOSTER

KELSEY - HAYES WHEEL CO., DETROIT, MICH.

Sold to Automotive Distributors by

EMPIRE ELECTRIC BRAKE CO., Newark 7, N. J.

VACDRAULIC is a Trade Mark of Empire Electric Brake Company

Developments in Brake Mechanisms

(*Continued from page* 38)

from the end where the actuating force is applied, to the end where the shoe is anchored pivotally, and the friction therefore tends to press each shoe more firmly against the drum, making it self-energizing. On reverse motion, however, the action is quite different. It will be seen from the drawing that the rear (left) shoe pivots on a fixed anchor pin *A*, and during reverse motion this shoe therefore is "de-energized." The front (right) shoe also has an anchor pin *B*, but does not completely surround it, and therefore is not restrained by it. During reverse motion, nearly equal actuating forces are applied to it at both ends, but the friction between it and the drum causes it to move away from anchor pin *B*, at its lower end, into contact with an anchor block *C*, at its upper end. This, therefore, is a floating shoe, and is not self-energized in the same way as a pivotally-mounted shoe, though a certain self-energizing effect may possibly be obtained from the wedging action between anchor blo and drum at the upper end of the sho

Another balanced brake of the h draulically-operated type was a nounced recently by the Timken-D troit Axle Company, and is known a its "DP" (Dual Primary) brake. Bo

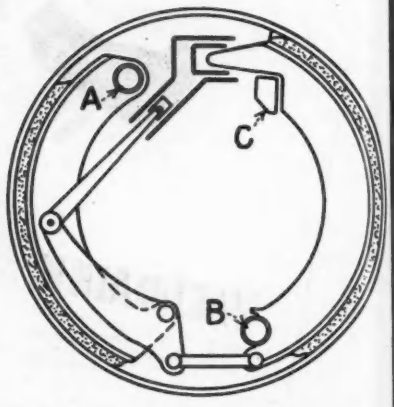
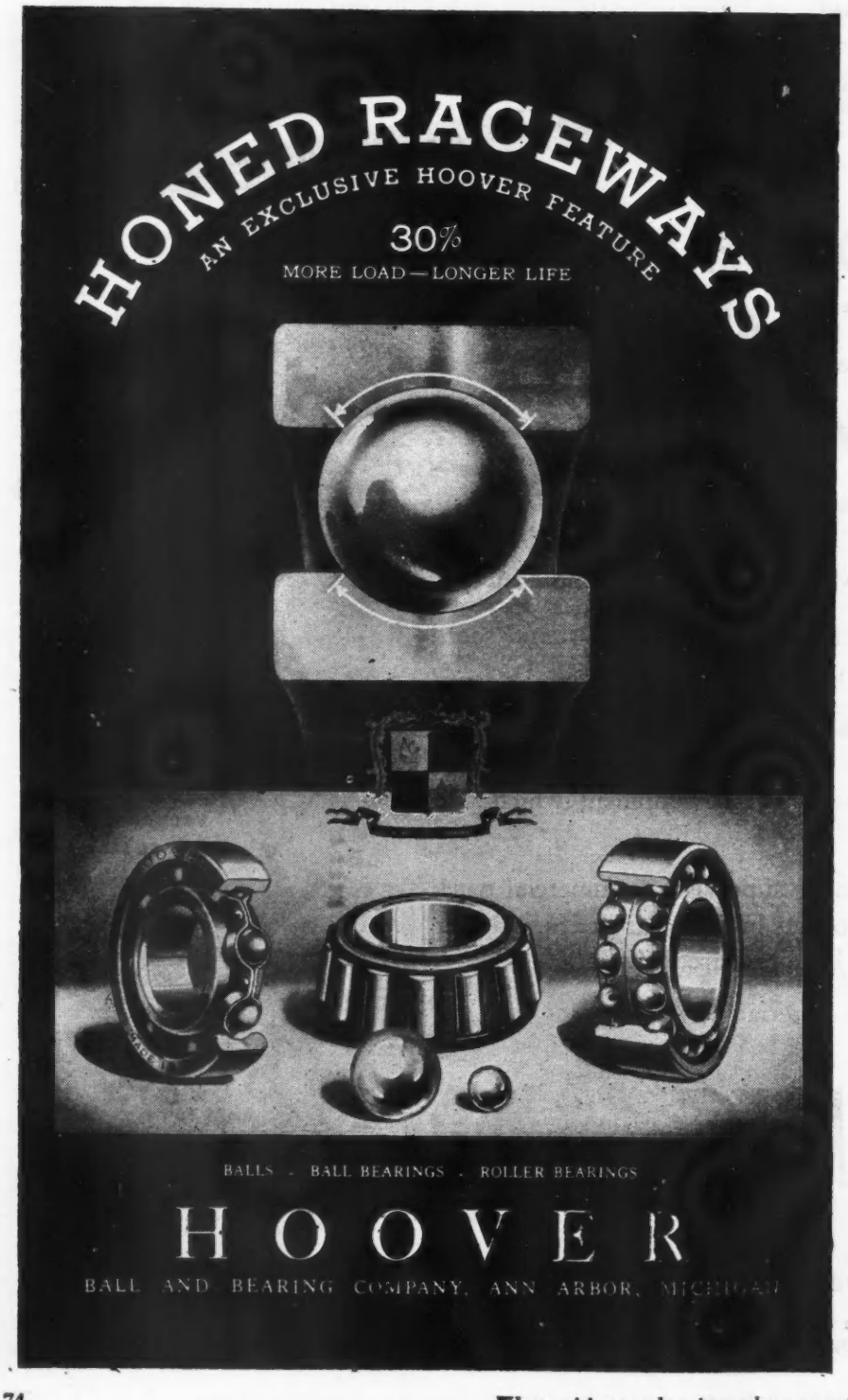


Fig. 6—Diagram of Wagner Hi-Tork brake.

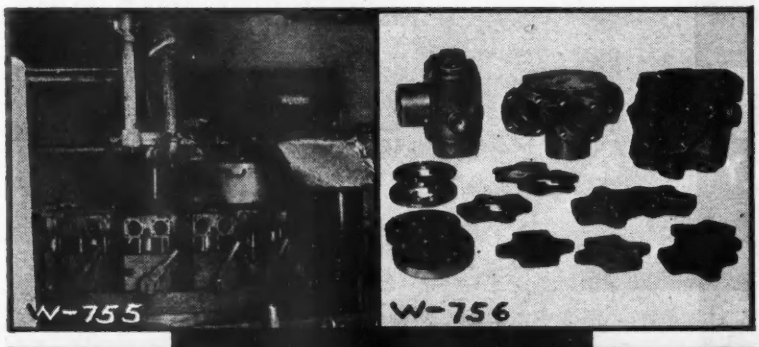
shoes are self-energizing during bot forward and backward motion, an this effect is obtained with a singl hydraulic wheel cylinder. An assembl view of the drum, shoes and expande mechanism is shown in Fig. 7. Th wheel cylinder, shown at the top, act on the shoes *E*, *E*, not directly, bu through the intermediary of the brak levers, *B*, *B*, which are fulcrumed o the eccentrically-mounted anchor pin *I*, *I*. The brake shoes, which "float," have the actuating force applied t them at the middle through pressur blocks *F*. The brake levers are o double construction, one-half being lo cated on each side of the brake-sho web.

When the pedal is depressed an brake fluid forced into the cylinder both shoes move radially outward int contact with the drum. Friction at th contact surfaces then carries them around in the direction of drum rota tion, until (for left-hand rotation) th left shoe contacts the lower abutment block *H*, and the right shoe an upper abutment block *D* (not shown in the illustration). This circumferential mo tion of the shoes is made possible by the fact that the pressure blocks *F* are movable laterally with respect to the brake levers. During reverse motion, when the drum rotates in the opposite direction, the right shoe ends up against the lower abutment block *H*, and the left shoe against the upper abutment block *D*. Retainer springs *G*, *G*, hold the pressure blocks *F* in place on the shoes when the brake is disassembled.

(*Turn to page* 76, *please*)

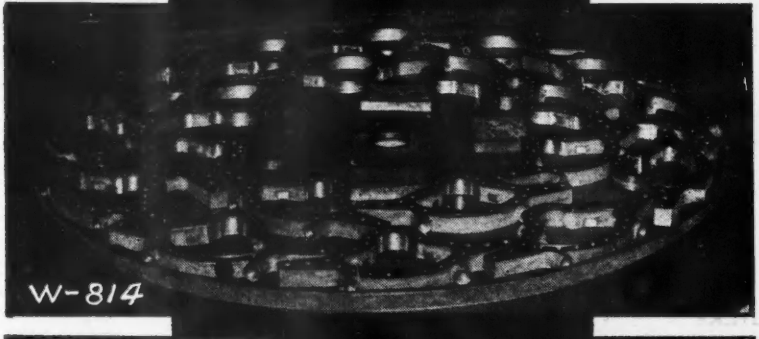


FOR CLOSE LIMITS-*Blanchardize*

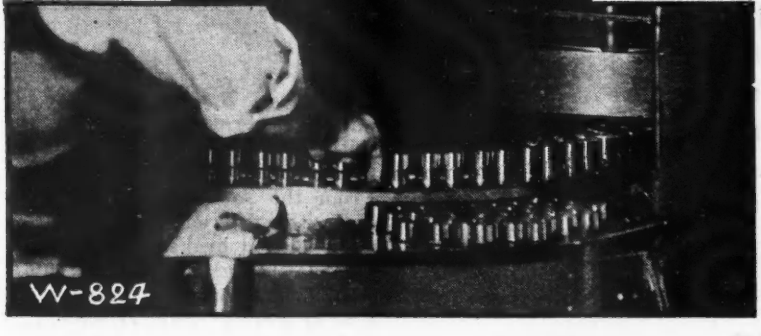


The Blanchard No. 18 Surface Grinder is used to rough and finish-grind these oil burner parts, and .012″ of stock is ground off one side to limits of +.0003″ −.0001″. (48 per hour)

Eighteen of these cast iron ball bearing spacers, with eighteen smaller spacers inside of them are ground to limits of .0002″ after removing .025″ of stock. (144 surfaces per hour)



This is an excellent example of accurate surface grinding of pump body parts on a No. 18 Blanchard Surface Grinder. The material is high strength forged steel and .004″ of stock is removed from each side to limits of ±.0003″. (80 surfaces per hour)



These heat-treated steel trunnion bearings are ground on a No. 16-A2 Blanchard Surface Grinder. They are ground to limits of ±.0005″ after removing .005″ to .015″ of stock. (2315 per hour)

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

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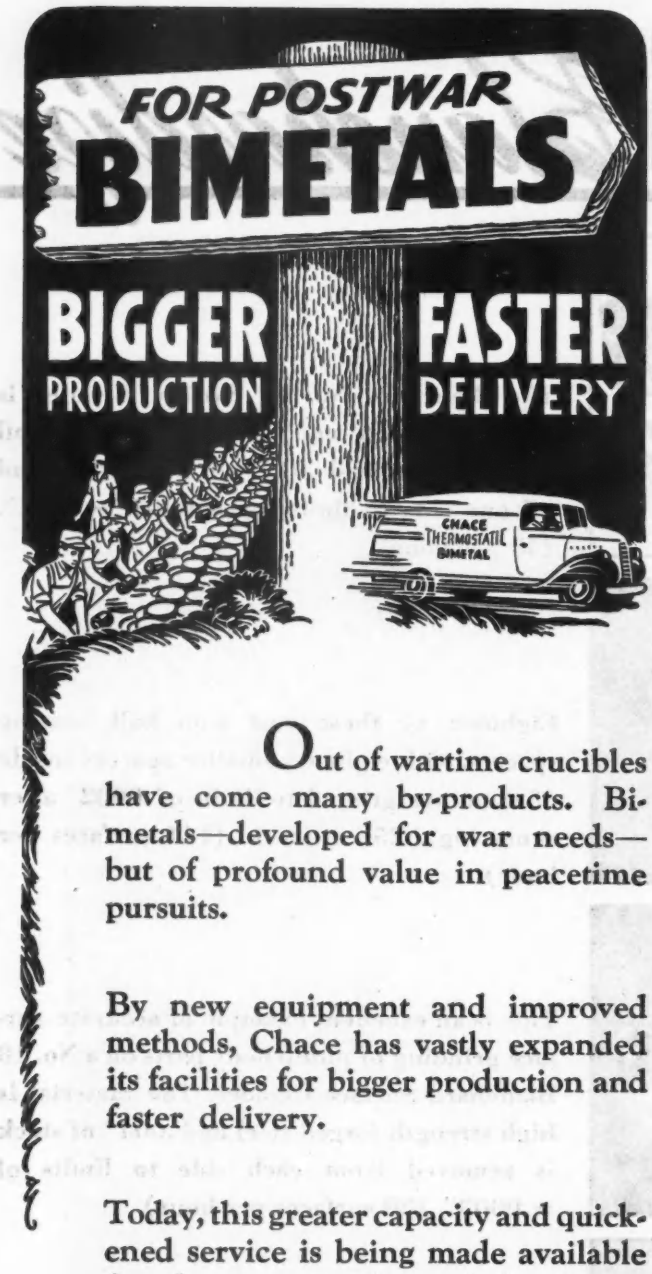

Out of wartime crucibles have come many by-products. Bimetals—developed for war needs—but of profound value in peacetime pursuits.

By new equipment and improved methods, Chace has vastly expanded its facilities for bigger production and faster delivery.

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CHACE BIMETALS 35 DISTINCT TYPES
SOLD IN SHEETS, STRIPS and FINISHED FORMS

In a brake of this design, the linings of both shoes naturally wear equally. Also, since the shoes "float," it is impossible for excessive local pressures to develop between shoes and drum, and the brake is claimed to operate quietly under all conditions. A special feature of the design is a shield *A* over the wheel cylinder, which is intended to reduce the heat flow from the brake drum to the brake fluid and the heat-sensitive parts of the wheel-cylinder assembly.

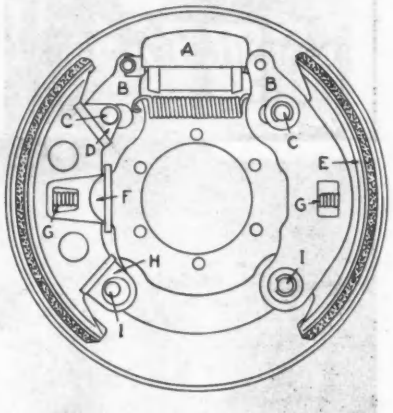


Fig. 7—Timken Dual Primary Brake. In this illustration half of left brake lever has been removed to show brake shoe, abutment blocks, pressure block and other parts which otherwise would be concealed from view.

A—Heat Shield. B—Brake Lever. C—Upper Anchor Pin (fixed). D—Upper Abutment Block. E—Brake Shoe. F—Pressure Block. G—Retainer Spring. H—Lower Abutment Block. I—Lower Anchor Pin (Adjustable Eccentric).

From the foregoing it is apparent that in the field of pedal-operated or direct-operated brakes the tendency at present is strongly toward the balanced type of brake with floating shoes.

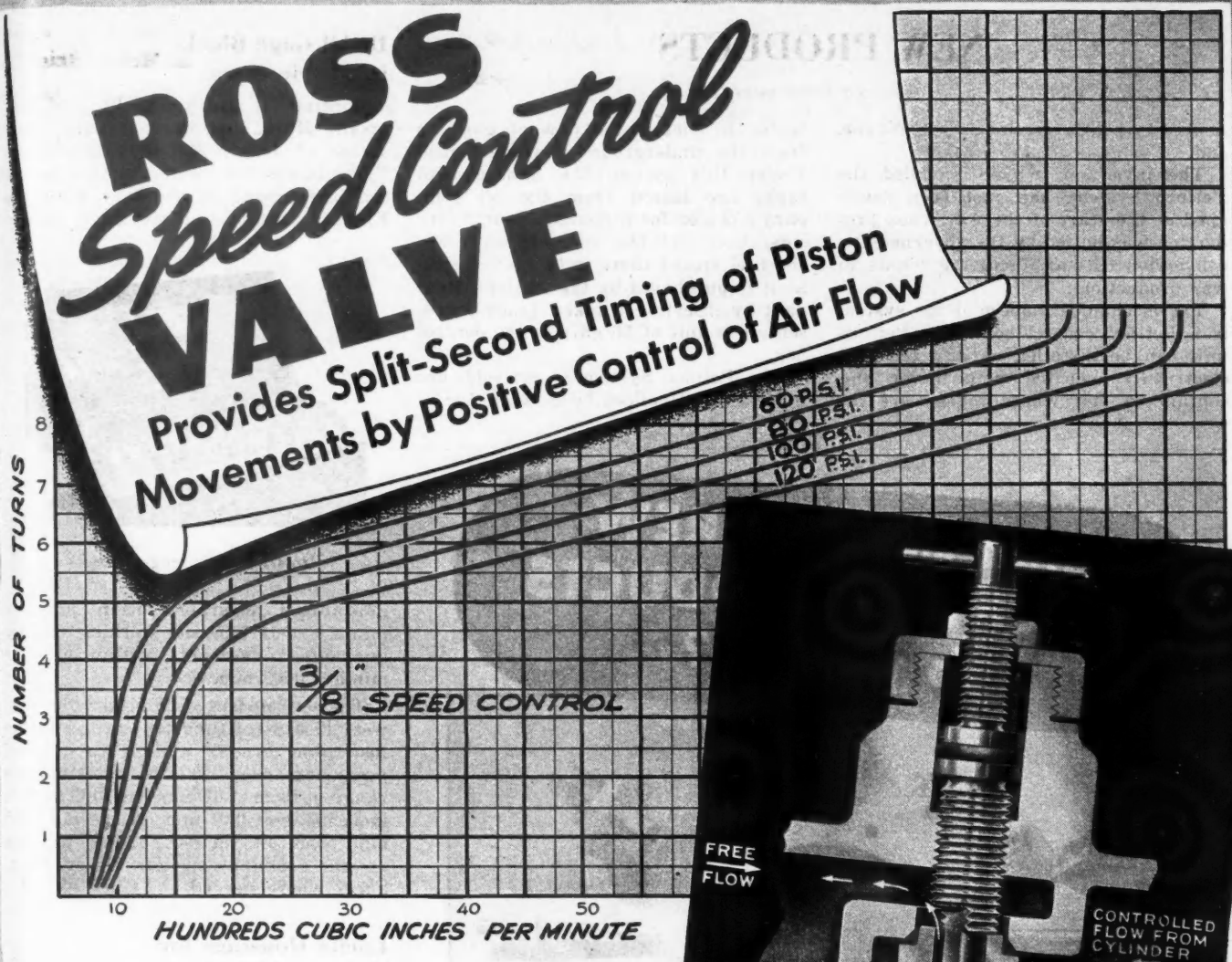
End of Part I. Part II will be published in an early issue of AUTOMOTIVE AND AVIATION INDUSTRIES.

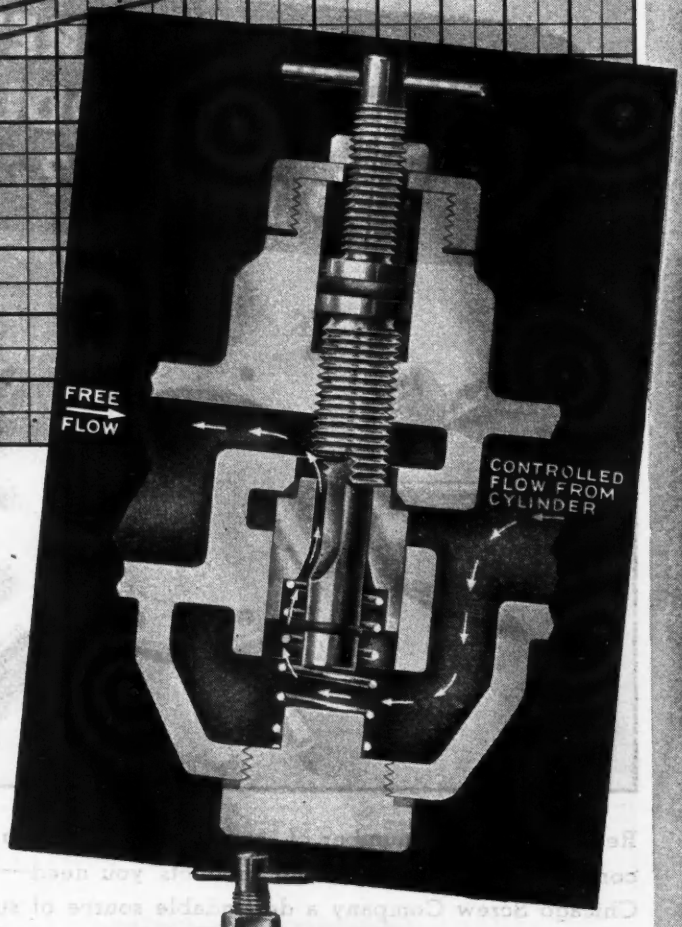
Continental to Build Diesel Engines

Continental Motors Corp. plans to enter the Diesel engine field with a new line of Diesel engines starting at 25 hp and covering a wide power range above that level. The company also will introduce an entirely new product in the near future.

ROSS Speed Control VALVE

Provides Split-Second Timing of Piston Movements by Positive Control of Air Flow

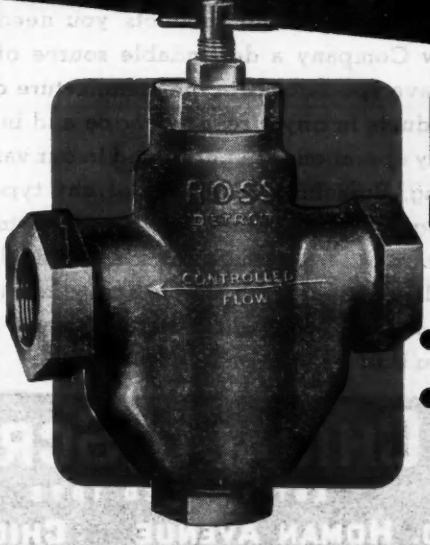




With air flow regulated by screw action, changes in volume take place with constant progression—not a series of "steps"—but with micrometer accuracy. Control of the air flow is absolute—from zero to maximum.

Simple—dependable—rugged. Only two moving parts—stem and poppet.

Write for bulletin which gives information on different sizes and applications.



ONLY 2 MOVABLE PARTS

- **STEM**
- **POPPET**

ROSS Air Control VALVES

THE BRIDLE FOR AIR HORSEPOWER

ROSS Operating VALVE CO.

6481 Epworth Boulevard
DETROIT 10, MICHIGAN

NEW PRODUCTS

(*Continued from page* 44)

nounced by Bowser, Inc., Fort Wayne, Ind.

The invention, which is called the Petinco System, had just been developed at the start of the war when production was halted by the government's conversion of manufacturing plants to war production.

The mechanical aspect of the system is a Petinco control box. The Petinco unit can be installed on any accurate electrically operated meter pump and contains a slot where tokens are inserted to control the flow of gasoline from the underground storage tanks. Under this system the underground tanks are leased from the oil company's dealer for a nominal yearly consideration and the oil company owns the fuel stored there until such a time as it is purchased by the station attendant by inserting a token (each representing a unit of 50 gal) in the control box.

The Petinco System is not sold, but is leased and policed by Bowser, Inc.

Regardless of the number of intricate finishing operations required to complete the Screw Machine Products you need—you will find The Chicago Screw Company a dependable source of supply . . . For over 73 years we have specialized in the manufacture of screw machine and cold upset products in *any size, any shape* and in unlimited quantities.

All secondary operations are performed in our vast factory, and include Milling, Drilling, Broaching, Grinding of any type—precision Thread Rolling, Hydrogen Brazing, Electronic Heat Treating—all are accurately and rigidly controlled from rough stock to finished product.

If your parts are simple screw machine items or really "fussy" jobs—try "Chicago Screw"—you'll find there is a difference.

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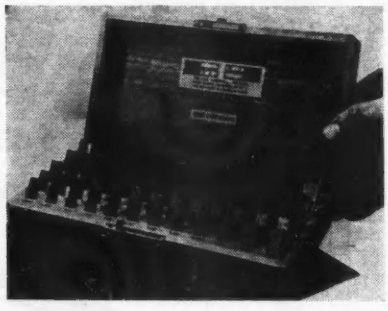
1026 SO. HOMAN AVENUE CHICAGO 24, ILL.

DoAll Gage Blocks in Metric Sizes

Continental Machines, Inc., Minneapolis, Minn., has brought out a new series of DoAll Metric gage blocks. These blocks are offered in two grades that correspond in accuracy with the English system. Inspection quality



DoAll metric gage blocks

guaranteed accurate within plus or minus 0.0001 mm and working quality guaranteed daccurate within plus or minus 0.0002 mm.

The set consists of 38 blocks plus two wear blocks (of tungsten carbide in the inspection grade) and is capable of producing over 100,000 combinations ranging from 1.01 mm to 100. mm in increments of 0.01 mm. A special 1.005 mm block in the set makes possible special combinations for closer tolerances where needed.

Lucite Housings for Portable Lights

A war-time use of "Lucite" methyl methacrylate resin is a cylindrical transparent housing used with portable industrial lighting equipment.

According to lighting manufacturers, the light-weight plastic housing, which is machined from tubes of the clear plastic, provides good light transmission, is practically unbreakable under normal working conditions and is water and vapor tight. A solid piece of "Lucite" rod inserted in the capped end is a positive seal against water and vapor. Also the plastic is not affected by water, gasoline or lubricating oils.

The complete lighting units, which are specially designed to bring illumination to remote, out-of-the-way places, are available in 6, 8, 15 and 30-watt sizes.

These fluorescent lighting units are manufactured and distributed by the Commercial Reflector and Manufacturing Co. of Los Angeles, Cal.

Magnetic Reversing Starter

A new a-c magnetic reversing starter, featuring a semi-interference-type mechanical interlock, is now in production at the General Electric Co. Available in sizes 0 and 1, the new starter is designed for full voltage

(*Turn to page* 80, *please*)

you can reduce die costs and assembly time with JESSOP

Sheet metal dies made from Jessop Composite Die Section Material.

COMPOSITE DIE SECTION MATERIAL

With the use of Jessop Composite Die Section Material, blanking or cutting dies can be made at a lower cost, saving from 28% to 47% over the cost of the same dies made from rectangular bar stock.

The cutting edge of Jessop Composite Die Section Material is electric furnace water-hardening tool steel, backed by a tough, non-hardenable steel. When Jessop Composite Die Section Material is used, there is no necessity for machining to shape because it is rolled to shape. Slow and expensive hand lapping is eliminated and dowel holes may be drilled after hardening.

Jessop Composite Die Section Material is recommended for straight die sections and for slightly bent sections.

Eight different shapes are available in lengths of 8 to 10 feet. Applications include airplane sheet metal dies, auto body dies, truck body dies, railroad car dies, metal container dies, and any application in which sheet metals are to be cut to regular or irregular shapes.

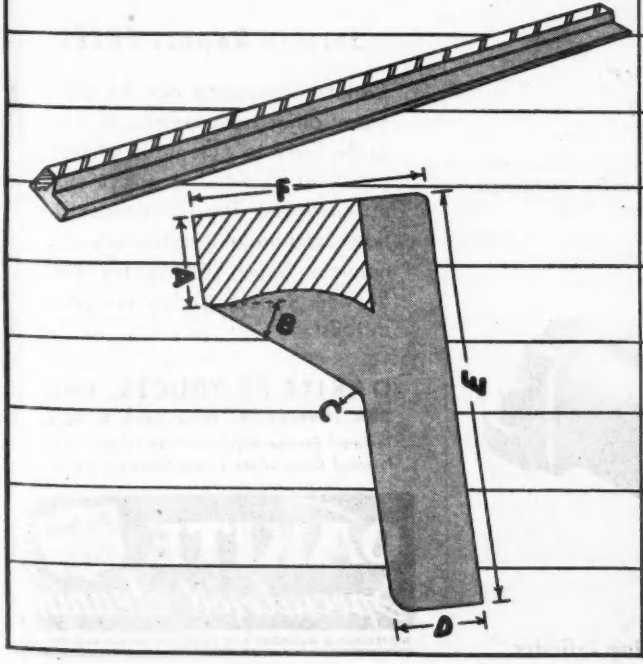
JESSOP STEEL COMPANY

Head Office and Works

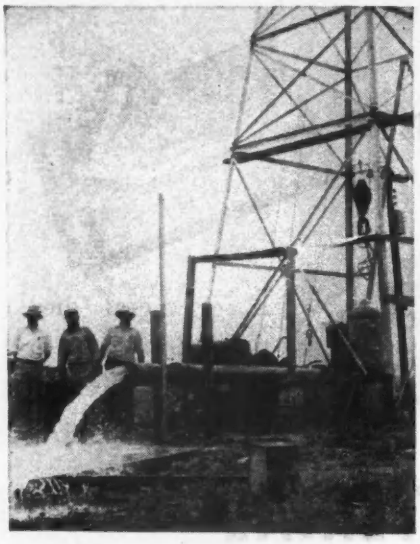
Washington . . . Pa.

Established 1901

ROLLED SIZES



Sec. No.	A	B	C	D	E	F	Weight
D	15/32	30°	1/4R	29/32	2 1/16	1 3/8	7.25 lbs.
AA	63/64	30°	1/4R	1 1/16	3 1/16	1 9/16	12.5 lbs.
A	31/64	30°	1/4R	1 1/16	2 9/16	1 9/16	10.83 lbs.
SS	63/64	30°	1/4R	1 1/16	3 3/16	1 15/16	14 lbs.
B	31/64	30°	1/4R	1 1/16	3 9/16	2 1/16	15.6 lbs.
BB	63/64	30°	1/4R	1 1/16	4 1/16	2 1/16	18.44 lbs.
C	31/64	30°	1/4R	1 1/16	4 1/16	2 5/8	19.3 lbs.
CC	63/64	30°	1/4R	1 1/16	4 9/16	2 11/16	23.94 lbs.



Industrial Expansion Will Call For

MORE WATER

And low cost per Million gallons is going to be a mighty important factor. That brings Layne Well Water Systems and Layne Vertical Turbine Pumps squarely into the picture. Layne Water Producing equipment has always been highest in efficiency, consequently lowest in cost to operate.

In the first place, Layne is the World's largest builder of Well Water Systems—and makers of the finest quality Vertical Turbine Pumps. For years Layne has operated in almost every part of the world, thus gaining experience and knowledge of unmistakable value. Layne built more Well Water Systems for World War II industries, camps, and air fields than any ten competitive firms combined.

If you are looking toward economy in your industrial water system, Layne has many basic facts to present—facts that may save you many hundred dollars annually. Write, wire or phone for further details. LAYNE & BOWLER, INC., General Offices, Memphis 8, Tennessee.

***LAYNE PUMPS** —fulfill every need for producing large quantities of water at low cost from wells, streams, mines or reservoirs. Send for literature.*

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minnesota, Minneapolis, Minn. ★ International Water Supply Ltd., London, Ontario, Canada ★ Layne-Hispano Americana, S. A., Mexico, D. F.

LAYNE

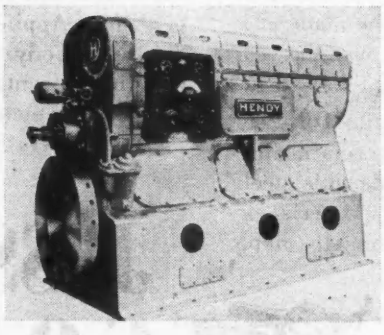
WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

starting of squirrel-cage induction motors, although it can easily be used for reversing service when combined with a reduced voltage starter.

The new semi-interference-type mechanical interlock prevents the closing of one contractor while an arc is maintained on the other, thus averting a short circuit through the arc and the resultant burned contacts and blown fuses. In addition, the interlock arm of the closing contactors assists the interlock arm of the opening contactor in reaching its fully opened position.

Hendy Offers New Line of Diesel Engines

The Joshua Hendy Iron Works, Sunnyvale, Cal., is now producing its new Series 20 Diesels in six and eight-cylinder models with a power range of from 190 to 250 hp at 900 rpm. The D-26 and D-28 are made in marine,



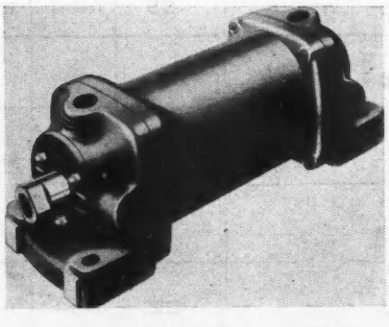
Hendy Series 20 Diesel engine

stationary and Diesel-electric models, and are of the four-stroke cycle type, designed for heavy-duty, medium-speed operation. They are air starting and completely enclosed, with overhead camshaft, unit fuel pumps and injectors, precision-type bearings and full pressure lubrication. Marine models are direct reversing.

Air Cylinders Feature Keeper Ring Design

Contributing to the modern design of the new Gerotor double-acting, non-rotating air cylinders, made by Gerotor May Corp., Logansport, Ind., is the complete absence of tie rods. Keeper

(*Turn to page 82, please*)



Gerotor double-acting cylinder

STOP RUST

Before Painting Steel

By Using NEW

OAKITE COMPOUND No. 86

By imparting a microscopic protective coating to steel and iron parts, OAKITE COMPOUND NO. 86 inhibits rust on surfaces of work being held for paint or similar organic finishes.

Not only does this revolutionary development impart a special RUST-RESISTING quality to steel and iron surfaces . . . it also provides effective removal of oil, grease and shop dirt. Moreover, this three-in-one special surface conditioning treatment assures better grippage and tenacious bonding of paint, lacquer and varnish.

Service Report FREE!

Oakite Compound No. 86 offers many other advantages. It is entirely SAFE to automatic washing machines for which it was primarily designed. The low concentrations used make it extremely economical. Send TODAY for FREE Service Report giving complete details!

OAKITE PRODUCTS, INC.
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Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *specialized cleaning*

Buy Bonds for Victory

MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

No wonder your dies are tops..

YOU'RE PRATT & WHITNEY EQUIPPED

No die shop customer can fail to be impressed when he sees Pratt & Whitney machine tools at work on precision equipment he is buying. He knows that he can expect just that much better quality and accuracy . . . two things he vitally needs as he lays his plans . . . for now and the future.

Remember this when you place your orders for tools, jigs, dies, fixtures and other equipment that you need now . . . or later when you swing back into civilian production.

Accuracy breeds accuracy . . . that's why Pratt & Whitney has earned such an enviable reputation among tool and die shops who pride themselves on turning out the finest quality work. For 85 years, the Pratt & Whitney standards have never changed. Keep an eye peeled for the Pratt & Whitney name on machine tools, small tools, and gages in the shops you pick to make your tools. It will pay dividends.

Working swiftly and accurately, this P&W Die Sinker not only lowers the costs of die sinking operations, but leaves such an excellent finish that hand work in every way is very much less. Ask us to tell you about P&W die making equipment . . . machines, cutting tools, and Kellerflex Flexible Shaft equipment for finishing and polishing.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT

ring design, instead, assures leak-proof construction and permits covers to be rotated to any position for convenient location of pipe connections. Keeper ring construction also permits more compact design of the cylinder and allows it to be applied in a minimum of space.

Gerotor cylinders can be used for 150-lb air and 300-lb oil and water service. Those used for oil hydraulic service can be had with auto type piston ring construction.

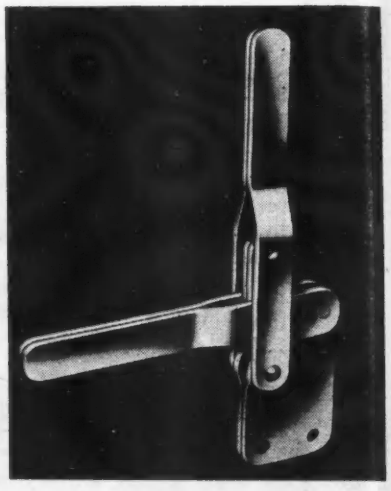
Synthetic Rubber Forming Pad

The United States Rubber Co. is releasing information on a new heat-resistant synthetic rubber forming pad used as the female die in hydraulic presses to form heated magnesium under 5000 tons of pressure. When compressed, the rubber transmits the full pressure of the hydraulic ram against the sheet, flowing into all irregularities and forcing the metal into the desired shape. When the pressure is released the rubber returns to its original form.

Instead of the usual set of mating dies used in hydraulic presses, this process calls for only one male die. The mating dies were formerly made of steel. The single die used with rubber may be made of softer material, such as plastics or zinc.

Toggle-Action Clamp for Flush Mounting

A new toggle-action clamp having a base straight in line with the handle for flush mounting has been designed by Knu-Vise, Inc., Detroit, Mich. Having a straight base, instead of a flanged



Model KV-216 toggle-action clamp

one, this clamp, known as KV-216, thus increases the range of mounting possibilities. It can be fastened upright, on its side, or at any odd angle to meet particular requirements. The toggle bar can be cut to meet requirements. With the pressure pad located at the normal position ⅝ in. from end of toggle bar a pressure of 240 lb can be obtained with a hand pressure on the handle of 70 lb.

British Car Prices Over Double Prewar Figures

The first prices announced in Great Britain for postwar automobiles indicate the British motorist will have to pay considerably more for them than he did before the war. For two Austin models the prices are over double the prewar figures. The 8-hp car (88.5 in. wheelbase) is priced at £326, including £71 purchase tax, an increase of 119 per cent over the 1939-40 price of £149. The price of the 10-hp car (94 in. wheelbase) is £397, including £87 purchase tax, as compared with a figure of £185 for a 1939-40 car. There was no purchase tax on automobiles in Great Britain before the war.

Turco Steam-Off

A heavy-duty steam cleaning compound is being marketed under the name of Steam-Off by Turco Products, Inc., Los Angeles, Cal. It is said to be particularly effective in the removal of the heaviest, most stubborn grease and dirt from iron and steel surfaces, concrete, brick and structural materials, gasoline and Diesel engines, steam shovels and tractors.

CYLINDER LINERS

BRAKE SHOES

A DEPENDABLE SOURCE OF SUPPLY

For 90 years we have been supplying castings to manufacturers who wanted good value. Today, as a result of steady growth, our foundry is casting large quantities of parts in ALL ferrous metals—gray iron, Gunite, malleable, and steel. Items of particular interest to the automotive trade are shown here — Brake Drums (rough or completely machined), Cylinder Liners, and Brake Shoes (rough castings only). With experienced engineering service, efficient production methods, and careful laboratory control, we can provide a dependable source of quality castings. ***Let us quote on your next order.***

MADE BY
GUNITE FOUNDRIES
ROCKFORD, ILLINOIS

GUNITE CASTINGS...FOR TRUCKS, TRACTORS, TRAILERS, and BUSES

New Production Equipment

(*Continued from page 42*)

thread to be generated. One roll revolves about a stationary axis, while the sizing roll, mounted on a heavy dovetail slide, is hydraulically fed to a predetermined point and automatically released by the electric tripping device and returned to its starting position, allowing the piece to be removed.

There is no axial movement of the workpiece during the generating cycle, the blank merely revolving in contact with the threaded rolls. The workpiece is removed from the machine with its outside diameter threaded to the form desired and to the length presented to the rolls.

Sheet Steel and Strip Demand

(*Continued from page 46*)

ond quarter reserves having been so sharply depleted that a few days ago one Pittsburgh district furnace was reported to have no more than a week's margin of basic material on hand. Not a few furnaces are, moreover, in urgent need for repairs and hot weather conditions have aggravated production problems.

Interest on the part of the scrap trade in battlefield scrap is at a low ebb. The rubble left behind in the bombardment of Nazi war industries poses so tough a problem in the segregating of metallics that the job is being wished on to Europeans who need the scrap urgently to rebuild the harmless part of their economy.

Formal ending of the Controlled Materials Plan is being acclaimed chiefly because of its doing away with some of the paper work that metal marketers have had to do. Aluminum extrusions are not included in the release of upward of a hundred million pounds of aluminum a quarter for civilian end-uses. Control regulations governing vanadium and cobalt have been eased, production of cobalt in the Belgian Congo and refining operations at Antwerp having been increased in recent weeks. The supply of tin is such as to call for continued elimination in all non-essential uses, but is no more acute than it has been right along.

GM Delivers Coaches

The General Motors Truck and Coach Div. made the first major delivery of civilian passenger coaches since the start of the war when it recently delivered 75 coaches to New York and Chicago transit companies. At the end of April, the division had on hand orders for 5632 coaches, of which it expected to deliver 3575 before next Jan. 1.

Complete Your Production Picture

WITH HOLTITE Fastenings

In your present and future production plans, careful consideration should be given in determining the type of fastenings best suited for each particular application.

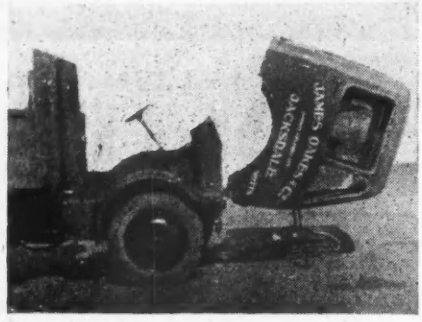
Eliminate all doubts by submitting your fastening problems to our Engineering and Laboratory Staffs. They will complete your production picture by recommending the most efficient, economical method of fastening the vital parts of your products. Specify HOLTITE engineered fastenings — made with the precision of small tools

HOLTITE PHILLIPS RECESSED HEAD SCREWS

Cut fastening time in half by changing to HOLTITE-Phillips Recessed Head Screws and bolts. Replace hand driving with safe spiral and power driving even on finished parts. The tapered bit cannot slip from recessed head to spoil work or injure operator. Adopt this modern screw driving method as standard practice to reduce fastening time an average of 50%!

CONTINENTAL SCREW CO.

New Bedford, Massachusetts, U.S.A.

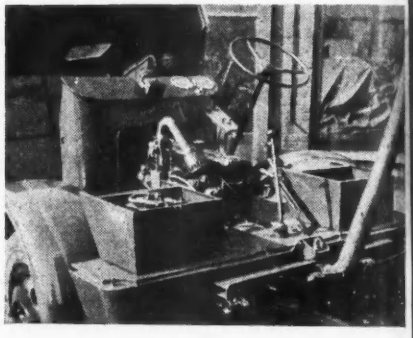


Hinged driving cab of Neville COE truck swung forward and resting on a pair of legs.

Hinged Driver's Cab On COE Type Truck

ALTHOUGH the cab-over-engine type of truck has unquestionable advantage in providing additional loading space on a chassis of given wheelbase, without increase of rear overhang, it has normally a drawback in reducing the accessibility of the engine for inspection, test, maintenance and removal. This drawback has been overcome by a British firm of body-builders (G. E. Neville & Son, Mansfield) by constructing the driver's cab in two parts. The lower part consists of a sub-frame carrying the floor, engine cover and fenders, while the upper part comprises the cab proper. The upper part is so designed and mounted as to be capable of being swung forward on a transverse hinged joint in front of the radiator near the bottom of the latter. When this has been done, and the engine cover lifted away, the engine is accessible.

The tilting forward of the cab can be done by two men in three minutes, including the removal of six nuts se-



View of COE truck engine showing ease of access when the hinged cab is swung forward.

curing it to the sub-frame. In its forward position it rests on a pair of legs, normally mounted flush against the side framing of the windshield. Alternatively, the front end of the roof can be allowed to rest on the ground.

Wedge-Drawing Test

(*Continued from page* 27)

an inherent disability in the wedge-drawing test, and that if reliable figures for drawing capacity are required, it does not provide a satisfactory alternative to the cup-drawing test. But since the only objection to the cup-drawing test which does not apply equally to the wedge test appears to be the need for a series of punches (or dies) to accommodate blanks of different thickness, the general position need scarcely be regarded as desperate."

Advertising Note

Leo Baron, general director of the news bureau of Transcontinental & Western Air, Inc., for the past five years, has joined John A. Cairns & Co., New York, as an account executive and member of the plans board.

Where dependability is a "must," where you need strength and stamina and efficiency that can be taken for granted—in the KEY MAN spots, rely on Aetna Bearings. Built into them are the toughness and enduring efficiency that are marks of champions.

Today, as never before, industry is studying how wider use can be made of anti-friction bearings in the "key man" positions—not alone in designs of new products but to rejuvenate old ones.

Are you grooming your products for the bitter competition of tomorrow? Talk to our engineers—they are helping the key men of many businesses.

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Aetna BALL & ROLLER BEARING

HERE'S TOPS IN FLEXIBLE CORDS

IT'S DRAGGED over rough concrete, through metal shavings, grease, and water. It's coiled, twisted, and stepped on. But this tough, flexible cord stands the gaff. It's a Whitney Blake portable tool cord—approved by Underwriters Laboratories, and protected with VINYLITE plastic insulation!

The dielectric strength of this modern insulation permits the small diameter construction important to many instrument applications. And VINYLITE plastic wire and cable insulation has remarkable resistance to abrasion and impact, oils, grease, alkalies, most acids, and the aging action of air and sunlight. Some types are non-flammable, others slow-burning. All remain flexible at low temperatures. Thin-wall construction permits a greater number of circuits in existing conduits — and VINYLITE plastic insulation can be made in colors for quick identification.

VINYLITE plastic insulation is bringing widespread improvements to the makers of electric and electronic equipment, public utilities, construction concerns, and manufacturers of marine, automotive, and airplane products. Adopt it for your own requirements. Write for booklet 15-VR. "VINYLITE Plastics for Wire and Cable Insulation." It's yours for the asking.

BAKELITE CORPORATION

Unit of
Union Carbide and Carbon Corporation

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30 EAST 42ND ST., NEW YORK 17, N.Y.

Vinylite Plastics

TRADE-MARK

PERSONALS

(*Continued from page* 50)

ucts, **J. A. Rumpsa**, Director of Purchases.

General Electric Co., Electronics Dept., **P. G. Caldwell** and **E. A. Leach**, Sales Mgrs. in Transmitter Div.

Thompson Products, Inc., **Ernest C. Breisford**, Asst. to J. H. Coolidge, Vice-Pres. and Treas.

Thompson Products, Inc., Service Div. Sales Dept., **Charles A. Cole**, Asst. Gen. Sales Mgr.; **T. A. Rowe**, Eastern Sales Mgr.; **G. C. Collins**, Cleveland Service Div. Field Engineer; **R. J. Vigneau**, Seattle District Mgr.; **Wm. B. Wise**, Pittsburgh District Mgr.; **Glenn L. Quale**, Oklahoma City District Mgr. and **Ray Sweitzer**, Field Representative.

Monroe Auto Equipment Co., **G. J. Smith**, Chief Engineer.

Libbey-Owens-Ford Glass Co., **C. Dean Lowry**, Sales Promotion Mgr.

Warren City Mfg. Co., Sub. of Graham-Paige Motors, **Forest W. King**, Works Mgr.

Wickwire Spencer Steel Co., **Sidney E. McCrum**, Asst. Adv. Mgr.

Victor Mfg. & Gasket Co., **Edward Gammie**, General Sales Mgr.

The Bunting Brass & Bronze Co., **Robert R. Hirsch**, Vice-Pres. in Charge of Sales.

R. M. Hollingshead Corp., Directors, **R. M. Hollingshead, Jr.**, **Stewart Hollingshead**, **Weir Mitchell**, **T. J. Bagley** and **Ira Jewell Williams, Sr.** Officers of the company, Chr. of Board, **R. M. Hollingshead, Jr.**; President, **Stewart Hollingshead**, Vice-Pres., **T. J. Bagley**; Secretary, **Miss Dorothy Butler** and Treasurer, **Weir Mitchell**.

United States Rubber Co., **A. C. Martin**, Mgr. Airplane Tire Dept.

Motor Products Corp., Deepfreeze Div., **F. F. Duggan**, General Sales Mgr.

Allegheny Ludlum Steel Corp., **J. J. Grogan**, Asst. Treas. and **V. H. Mantz**, Asst. Sec.

Thermoid Co., **H. W. Overman**, Chg. of Industrial Friction Materials.

Illinois Tool Works, **John A. Callanan**, Mgr. Electronics Div.

E. I. du Pont de Nemours & Co., resignation of **Dr. Charles M. A. Stine** as member of executive committee, will remain as vice-president and director.

Owens-Corning Fiberglas Corp., **T. E. Butterworth** head of Storage Batteries Div.; **M. W. Butler**, Mgr., Philadelphia branch office.

The Goodyear Tire & Rubber Co., **R. W. Richardson**, Mgr., newly inaugurated Aviation Products Div.

Allis-Chalmers Tractor Div., **Marshal L. Noel**, General Sales Mgr.

North American Philips Co., Inc., **Dr. O. S. Duffendack**, Vice-Pres. and Director of Research and Engineering; **E. J. Kelly**, Vice-Pres. and General Factory Mgr.

Trimount Instrument Co., **Donald O. Kocmich**, Vice-Pres.

National Motor Bearing Co., Inc., **K. H. Pohlman**, elected President and Gen. Mgr. of Arrowhead Rubber Co., a subsidiary.

Cutbacks Increasing

(*Continued from page* 46)

Tarrytown, N. Y., and Atlanta. Operations at Flint are said to be waiting on completion of the new assembly plant scheduled for construction there in the near future, probably this year. The Atlanta plant currently is being expanded.

According to a recent tabulation by the WPB regional office at Detroit, cutbacks, terminations, and production readjustments in that area have brought about a reduction of slightly less than 20 per cent under the level of Jan. of this year. This is considerabl greater than the 12 to 15 per cent pr dicted for the country by J. A. Kru WPB chief for the first three mont after V-E Day. The expected redu tion for the Detroit area in the fir quarter after V-E Day now stands from 25 to 30 per cent.

Awards

Names of winners of Army-Navy awards in or allied with the automoti and aviation industries announced sin the May 15 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES went to press:

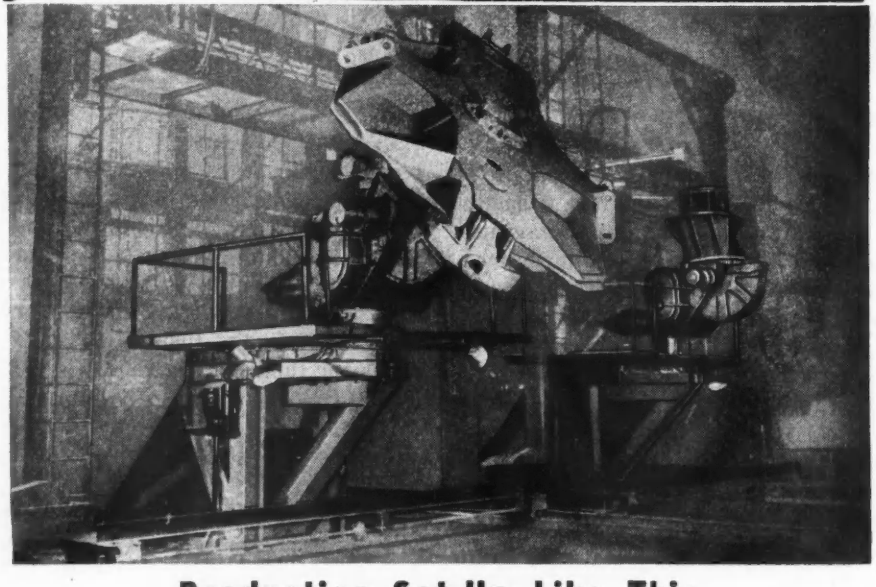
DAYTON RUBBER MANUFACTURIN CO., Kansas City, Mo.
E. I. DU PONT DE NEMOURS & C INC., Wilmington Shops, Wilmingto Del.
FIRESTONE TIRE AND RUBBER C Firestone Textile Plant, Bennettsvil S. C.
THE HALOID CO., Rochester, N. Y.
THE JAMES C. HEINTZ CO., Clevela Ohio.
HERCULES BODY CO., INC., Evansvil Ind.
HERCULES POWDER CO., Hattiesbu Plant, Hattiesburg, Miss.
INDUCTION HEATING CO., Claw Mich.
LAVELLE AIRCRAFT CORP., Newto Pa.
NOBLITT SPARKS INDUSTRIES, INC Orinoco Division, Columbus, Ind.
REYNOLDS METALS CO., Richmo Plant, Richmond, Va.
SYLVANIA ELECTRIC PRODUCTS, INC Wakefield, Mass.
VERSON ALLSTEEL PRESS CO., Chica Ill.

★ **"E" Star Awards** ★

for continuous meritorious services on th production front have been awarded to th following firms:

BENDIX AVIATION CORP., Eclips Pioneer Division, Teterboro, N. J.
FARRELL-BIRMINGHAM CO., INC., A sonia, Conn.
FARRELL - BIRMINGHAM CO., INC Derby, Conn.
FARRELL-BIRMINGHAM CO., INC., Bu falo, N. Y.
FEDERAL MOTOR TRUCK CO., Detro Mich.
FORD MOTOR CO., Richmond Tank D pot, Richmond, Cal.
INTERNATIONAL CHAIN & MFG. CO York, Pa.
McCOED CORP., Detroit, Mich.
MONROE AUTO EQUIPMENT CO., Mon roe, Mich.
RAYBESTOS-MANHATTAN, INC., U. Asbestos Div., Manheim, Pa.
ROHM & HAAS CO., Bristol Plant, Bri tol, Pa.
WESTINGHOUSE ELECTRIC AND MAN UFACTURING CO., Elevator Division Jersey City, N. J.
WESTINGHOUSE ELECTRIC AND MAN UFACTURING CO., Lamp Division Bloomfield, N. J.
WESTINGHOUSE ELECTRIC AND MAN UFACTURING CO., Lamp Division Belleville, N. J.
WESTINGHOUSE ELECTRIC AND MAN UFACTURING CO., Lamp Division Trenton, N. J.
WESTINGHOUSE ELECTRIC AND MAN UFACTURING CO., Lamp Division Fairmount, W. Va.
WILLYS-OVERLAND MOTORS, INC., To ledo, Ohio.

C-F POSITIONERS



Production Set-Up Like This Forecasts A New "Shop Practice"

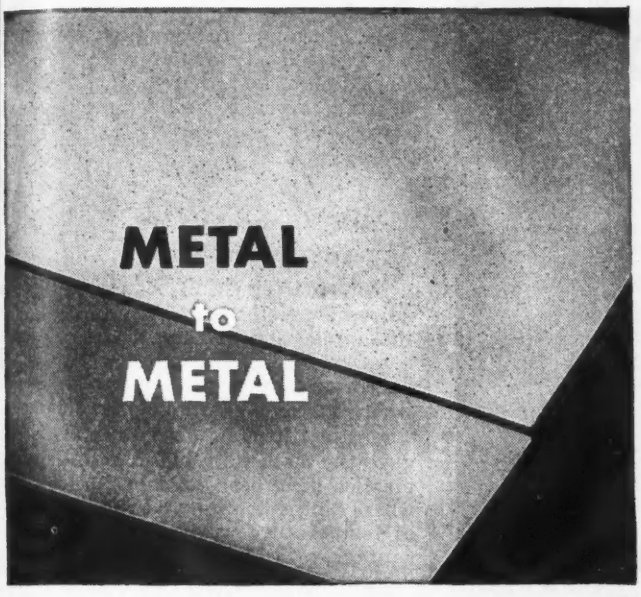
By *welding* on C-F Positioners, some manufacturers far out-produced all estimates of "possible War Production." Not only did this method increase output, it saved material and increased strength and quality while lowering the cost per unit. Under post-war competition automatic welding on C-F Positioners is certain to become standard manufacturing practice for many products. It is a new method that permits down-hand welding of all sides and angles from a single set-up. A method you should know and understand.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO. 1322 S. Kilbourn Ave. • Chicago 23, Ill.

Quick-Setting Plastic Adhesive that

TO ANYTHING!



Pliobond

—FOR IMPROVED PRODUCTION TECHNIQUES

Pliobond is one of American industry's great wartime achievements, now solving scores of production problems.

An all-purpose plastic adhesive that *simply* and *easily* bonds materials together which have never before been bonded successfully.

Pliobond joins any materials . . . like or unlike . . . metals, plastics, fabrics, glass, rubber, wood, ceramics, paper, leather, plaster, concrete, etc. For most applications, no high pressure or heat is needed. In others, where extremely high shear strength is desired, moderate pressure and 200 – 300° F. will produce a perfect bond.

When you use Pliobond, there's no elaborate procedure involved. It's a *one*-part bonding agent . . . always ready to go to work. No fussy mixtures. No careful weighing. No critical temperatures. It can be brushed, sprayed, spread or roller coated.

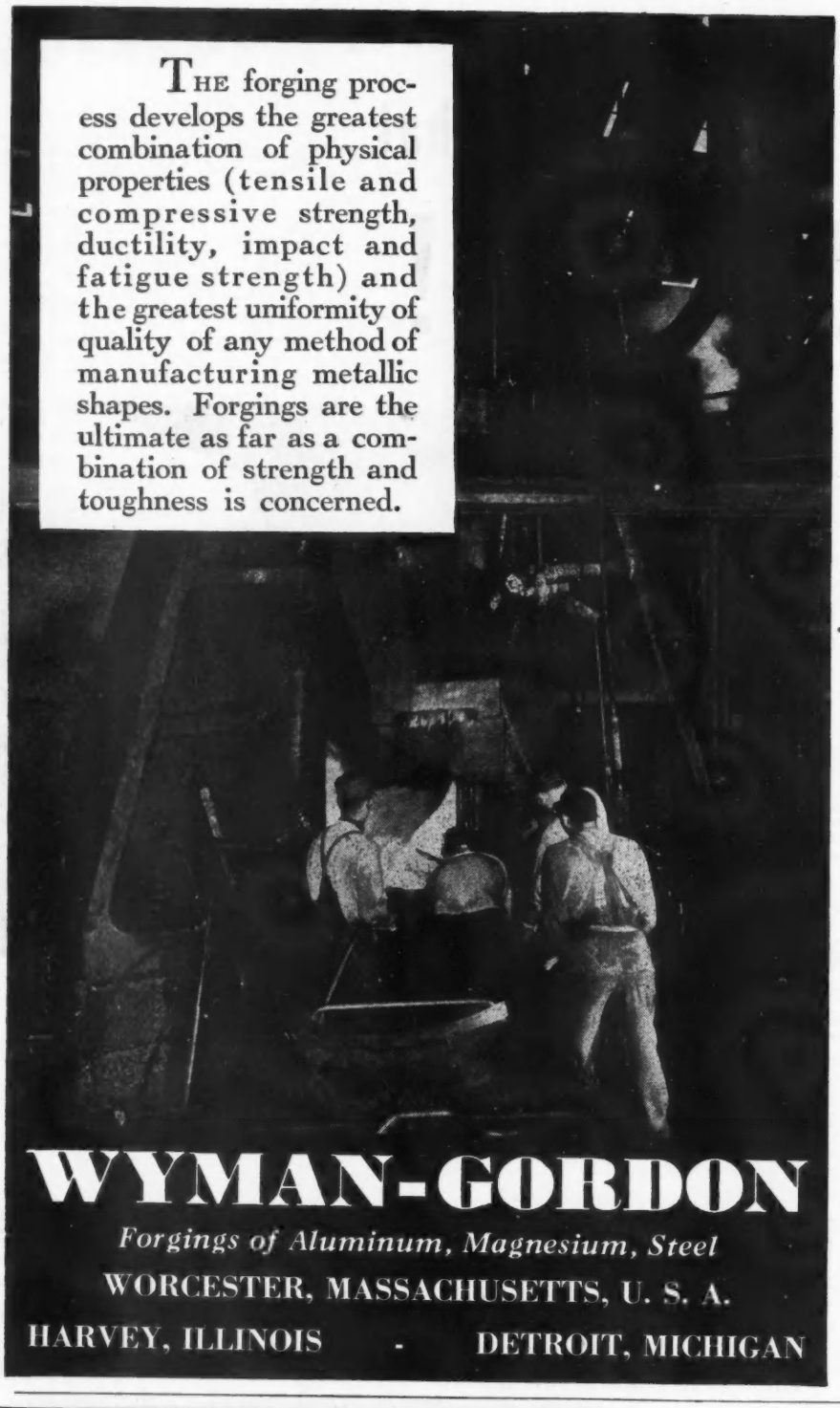
Manufacturing facilities for Pliobond are rapidly being increased to meet all demands. For sample and technical information, please use coupon, writing us in detail on any special problems.

UNITED STATES PLYWOOD CORPORATION *EXCLUSIVE DISTRIBUTORS*

Industrial Adhesives Division: 55 West 44th Street, New York . . . Branches in principal cities

***Pliobond* is a product of* THE GOODYEAR TIRE & RUBBER COMPANY**

*Trademark registered, The Goodyear Tire & Rubber Company


THE forging process develops the greatest combination of physical properties (tensile and compressive strength, ductility, impact and fatigue strength) and the greatest uniformity of quality of any method of manufacturing metallic shapes. Forgings are the ultimate as far as a combination of strength and toughness is concerned.
WYMAN-GORDON
Forgings of Aluminum, Magnesium, Steel
WORCESTER, MASSACHUSETTS, U. S. A.
HARVEY, ILLINOIS - DETROIT, MICHIGAN

Production Side Lights

(*Continued from page* 31)

Cases such as these are readily recognized by small subcontractors who begin with an experimental or small lot and later receive a substantially larger contract. It is suggested that some relief is necessary for such subcontractors and contracts should be written with this in mind. It is also true, and this is where the organization will—if not properly arranged — err, that when larger contracts are subdivided among a number of smaller plants, results are obtained more rapidly than when the work is confined to a single large plant but it is also true that if the production design and the production engineering coverage are not adequate, the reverse will occur and confusion will be compounded.

Watch Application of Materials & Methods

New materials, in many cases, require new methods of manufacture and the application of these new materials must be carefully watched. The use of beryllium-copper is a case in point where injudicious application in places where brittleness was a critical factor gave the material a bad name. Certain plastics have been used in applications where high vibration and rapid changes of temperature worked to their disadvantage.

Products of wrought magnesium may require hot forming to produce, which many plants are not equipped to do, and the new high strength aluminum alloys have caused some difficulty when used before methods of manufacture are properly developed.

Fairly recent methods such as copper furnace brazing, induction heating, heliarc welding, and the aforementioned hot forming, as applied to designs where strength and weight are of prime importance, all have their place in the production scheme; however, it is a long step from a single "exhibition" of these methods and materials to the establishment of production sequence

(*Turn to page* 94, *please*)

STAMPINGS

WORCESTER STAMPED METAL — QUALITY STAMPINGS

Heavy, medium and light stampings in any quantity. A steady flow of production—*when* you want it.

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WANTED—Pacific Coast representation of lines by an established concern which sells Automotive Jobbers, Hardware Jobbers, Chain Stores. We've been 25 years in the trade and know how to get the business. ALAN P. CLINE AND ASSOCIATES, 116 New Montgomery St., San Francisco 5, California. Offices in Los Angeles, Portland, Seattle.

AUTOMOTIVE AND AVIATION ENGINEERS: Specialists in various fields to work on fee basis. Important research organization requires outside assistance. State qualifications, specialty, background and references. Statement of availability required. Box 40, Chilton Co., Chestnut & 56th Sts., Philadelphia 39, Pa.

FULL SIZE BODY LAYOUT MAN (Door and Seat Experience). SHEET METAL LAYOUT DRAFTSMAN. Michigan firm with long established reputation in open car field will offer attractive proposition to the men who qualify for these jobs. Exceptional post war opportunities. Statement of availability required. Contact Mr. John Votypka, Motor State Products Co., Ypsilanti.

SULPHO HAND CLEANER

In many occupations, chemicals are encountered which tend to remove the normal fat of healthy skin and make it more susceptible to dermatitis. Some workers have naturally dry skin which cannot stand frequent washing with even the mildest soaps. For those who have naturally dry skin and for those who must in the course of their work dip their hands in solvents, degreasing compounds and similar materials, West offers this new special type of hand cleaner. Due to the nature of the product, it has an almost neutral pH. It is manufactured from the highest quality sulfonated castor and vegetable oils but its cost compares favorably with other products of lesser efficiency.

WILL NOT DEFAT THE SKIN

ESPECIALLY RECOMMENDED FOR WOMEN WORKERS.

WEST DISINFECTING *Company*

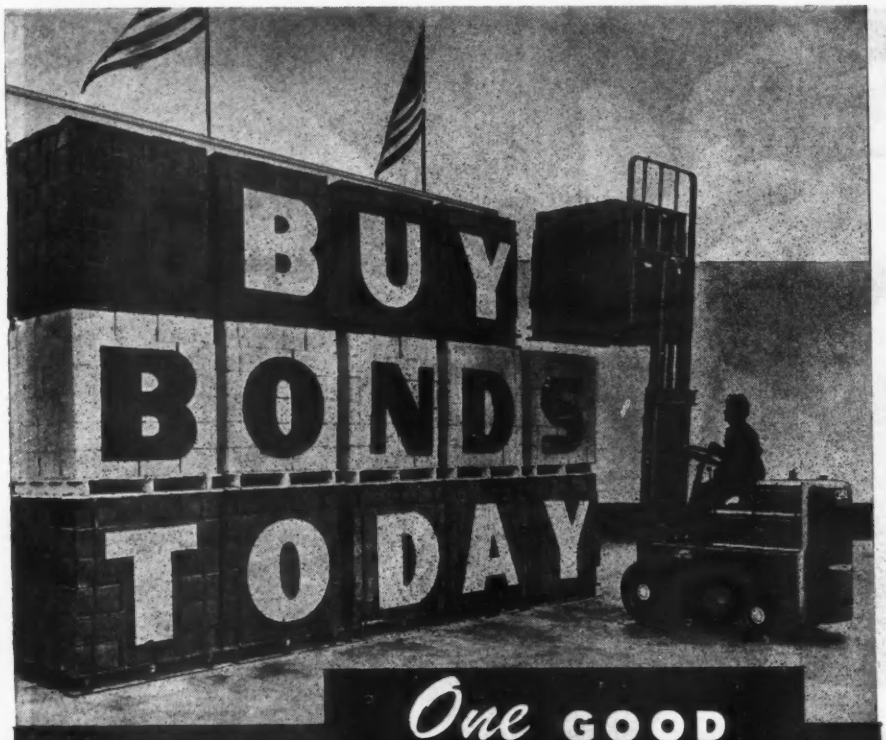
42-16 WEST ST. • LONG ISLAND CITY 1 • N. Y. • DEPT. AA

CLIP TO YOUR BUSINESS LETTERHEAD, PLEASE

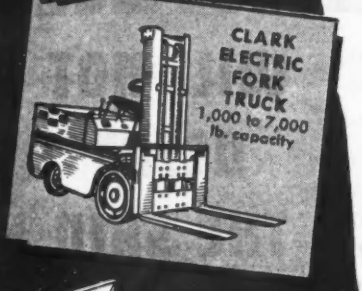
West Disinfecting Company,
Dept. AA, 42-16 West St., L. I. C. 1, N. Y.

Please send me a SAMPLE QUANTITY of Sulpho with which I will give your claim a practical test. Please include folder explaining its use.

Name .....Title .....



One GOOD INVESTMENT PROMOTES another



Cited for extraordinary usefulness and efficiency beyond the call of duty—the flexible, tireless

Pallet and CLARK fork truck

the extraordinary pair that speeds the flow of munitions, food and supplies to the point of use.

To see the wide range of usefulness of Clark Tructractors and Fork Trucks, send for handy 72-page pocket catalog—describes 60 husky, well engineered vehicles, gas and electric powered.

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Products of CLARK • TRANSMISSIONS • ELECTRIC STEEL CASTINGS
AXLES FOR TRUCKS AND BUSES • AXLE HOUSINGS • BLIND RIVETS
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METAL SPOKE WHEELS • GEARS AND FORGINGS • RAILWAY TRUCKS

utilizing them, and which are both rapid and economical.

Preparation For Production Includes Proving

In preparing for production there must be a period of incubation during which the design, the tools and the operational sequence are to be proved. This is a time of close coordination, cooperation and mutual understanding, of give and take between the designer and the production engineer. Failure to follow through can be disastrous or at least expensive. Sometimes the result may have an element of humor in it, as in the case of the exhaust collector segment for which three starter and one finishing dies were developed. One day, the operator inadvertently put the third starter die in place *first* and successfully formed a satisfactory lot of parts without trouble. As a result of this "error," two unnecessary starter dies were eliminated.

Tool design must be based on proper tolerances which are usually not considered in the light of production by the functional designer. In one case a .030 in. tolerance was allowed between two fittings on a structural component by the functional designer. The structure between these fittings was of sheet metal, comparatively light and subject to some warpage and distortion after assembly. A checking fixture was devised, to prove the location of the fittings, which reduced the designer's tolerance by one-half. It was later found that the fixture for making the assembly and the nature of the parts going therein took all the design tolerance and even more. A new tolerance was established on the basis of interchangeability and the tools were reworked accordingly.

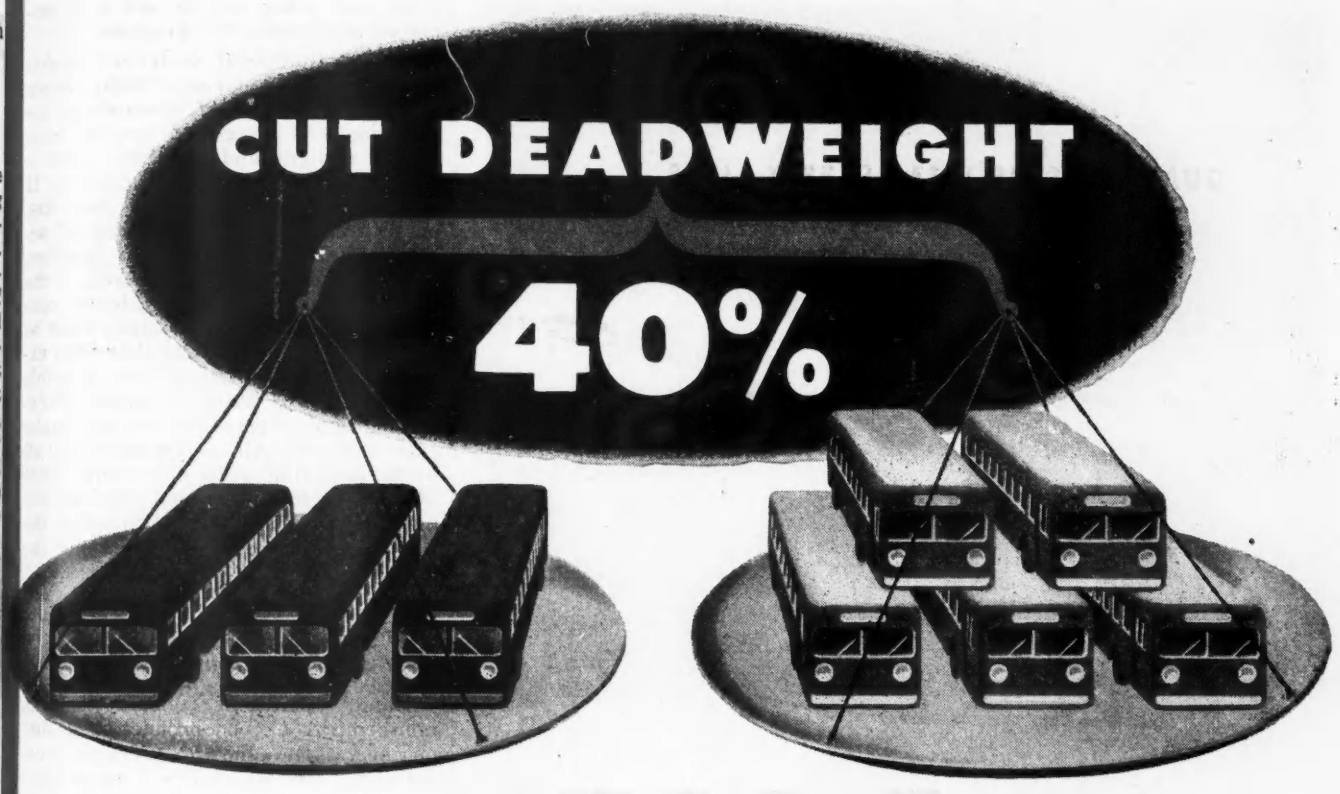
A particular sheet metal assembly was split laterally, the separate parts being joined by tension bolts through mating bulkhead rings. The purpose to decrease assembly time. Due to the lightness of the structures, gaps occurred at the joint between the bolts when the latter were drawn up. When the production engineer became aware of the problem, it was found that inspectors were using feeler gages to measure a sheet metal joint built to a nominal tolerance of plus or minus 1/32 in. Consideration of the flexure of the relatively light parts was not given in design, nor had a clear explanation of required tolerances been given to the men responsible for checking the same.

Standards Are Required

Standardization is a part of any production engineering job, even though a special product is made requiring special tools. Standards of form, of devices and of basic manufacturing procedures can be maintained. If the design can have standard parts, so much the better. In many industries there are countless tools all slightly different

(*Turn to page* 96, *please*)

CUT DEADWEIGHT 40%



with Mayari R*

You can reduce deadweight in busses, trucks and trolleys up to 40 per cent by building with Mayari R, Bethlehem's low-alloy, high-strength steel.

These reductions—with attendant increases in payload—are possible because Mayari R has almost double the yield point of regular structural steel and therefore can be used in lighter sections.

To protect these lighter sections, Mayari R has 5 to 6 times more resistance to atmospheric corrosion than mild carbon steel and 2 to 4 times more than copper-bearing steel. Tests reveal that it also has high enough endurance limit and resistance to fatigue and impact to withstand the strains and shocks of the toughest road conditions.

Mayari R's high ductility results in quick, easy fabrication under regular shop practices. And Mayari R is readily welded by all the usual methods.

Plan on designing postwar busses, trucks and trolleys with Mayari R. Taking into account weight savings, lower operating costs, longer life, and economical fabrication, you'll find that the advantages of using Mayari R far offset its slightly higher cost.

For complete information on Mayari R, write Bethlehem Steel Company, Bethlehem, Pa., for copy of illustrated booklet on this economical, weight-saving steel.

**Rhymes with "fiery." The "R" is for "Rust Resisting." Mayari, in Cuba, was the source of the original natural alloy-bearing Mayari ore.*

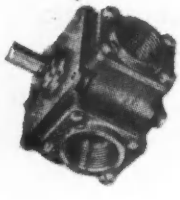
★ ★ ★ BETHLEHEM STEEL ★ ★ ★

Mayari R *makes it lighter... stronger... longer lasting*

DOLE

Aircraft Valves & Precision Fittings

to A-N Aeronautical Standards



Fidelity in protecting the smooth, uninterrupted flow of gas, oil, air, oxygen, etc. is the valuable contribution of Dole Aircraft Valves and Fittings to the success of combat missions—to the million miles of transport, so essential in the Pacific campaign. This is practical proof of precision in manufacture based on soundly-engineered design.

THE DOLE VALVE COMPANY • Established 1906 • 1901-1941 Carroll Ave., Chicago 12, Ill.

Los Angeles • Detroit • Philadelphia

from each other, due to lack of a concerted standardization program.

Couple functional designers' innate desire to improve on an existing design with the problem of controlling the stocking and usage of special tools within a plant and you have quite a problem in production engineering. If a standard is established on hole size, on fittings, or even in the way of accomplishing a certain design function, deviation should only be allowed on the basis of improved function, better control, or decreased cost. Designs must be analyzed by engineers familiar with existing tooling practices and possible applications of standard parts if design groups themselves do not make such analyses. All special tools and all parts requiring such operations must be tagged by production engineering until the end product is attained or the job will bog down somewhere along the line.

Hand Operations Add to Cost of Production

Hand operations should be an anathema to a good production design engineer. He should refrain from using methods which inject many hand operations too strongly into the production sequence. Workers are best used when operations are automatic, and tiresome, fatiguing and dangerous elements are absent. This is borne out in the following instances: A capping machine was devised for capping jars of preserves under heat and pressure. Caps were fed from a turntable, by hand, by two operators. Scrap ran 10 to 15 per cent due to the chute not being full, caps being fed in upside down, and faulty caps not being rejected. A tumbling barrel was designed and installed which reduced rejections to less than five per cent and only a part of a trucker's time was required to keep it full while the operator could exercise more control over output without difficulty. Again, a can line employed a vertical conveyor for carrying bodies to the flanger, and an operator was required to shut off the flanger when the conveyor was less than full to avoid jams. A solenoid was installed in the

(*Turn to page* 100, *please*)

VICTOR

GASKETS
OIL SEALS
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PRODUCT CONSULTANTS

on centrifugal fans and water pumps, gas engines, and general automotive equipment. If you have engineering problems on product design we will be happy to serve you.

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SPRINGS

"Measurably Better"

Service Springs

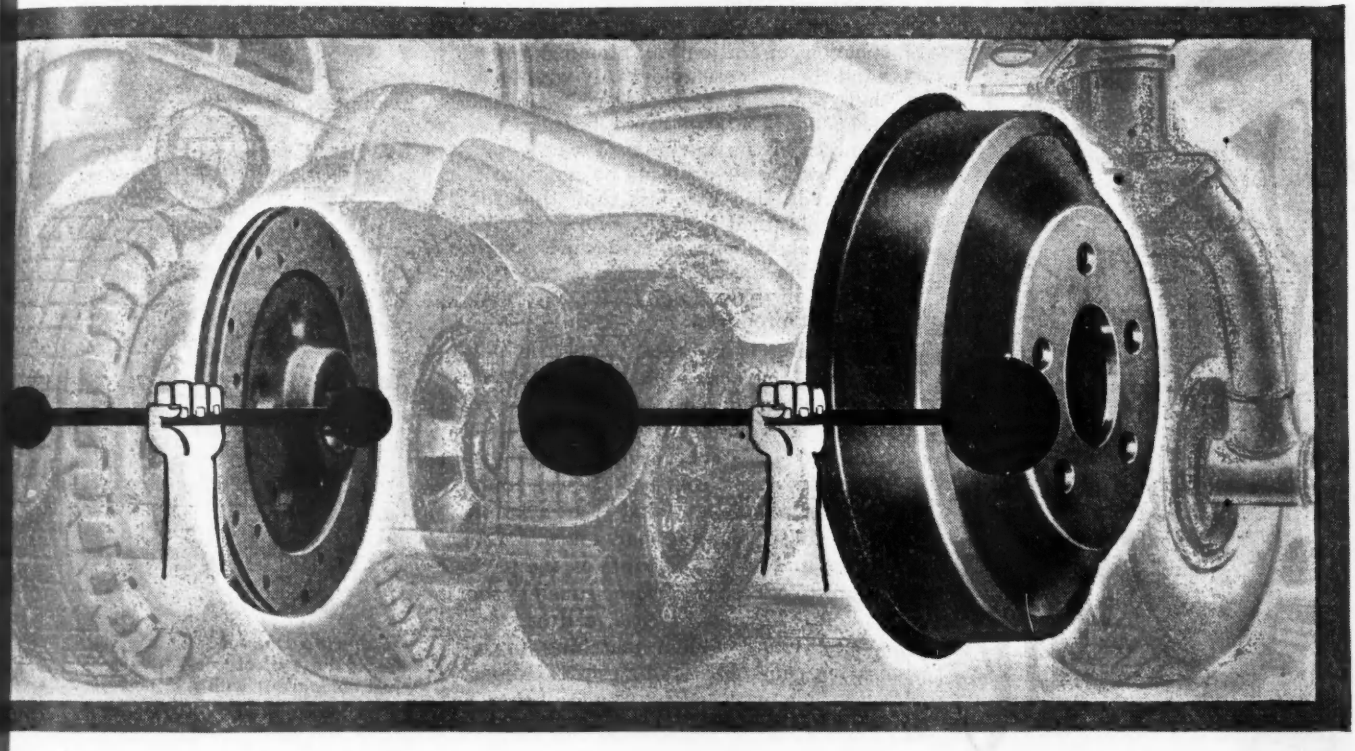
FOR ALL CARS AND TRUCKS

SERVICE SPRING COMPANY • INDIANAPOLIS 8, INDIANA

Elimination of Brake Drums

means LESS ENGINE POWER NEEDED TO START!

LESS BRAKING POWER NEEDED TO STOP!



Easier starting and stopping are two of the many advantages secured by the Lambert Disc Brake.

The elimination of the rotating brake drum required in the conventional internal expansion brake and the substitution of a rotating disc weighing up to 83% less means less inertia to overcome in starting . . . less to overcome in stopping.

Other advantages resulting from the elimination of the brake drum include . . . EASIER WHEEL BALANCING . . . no brake drum scoring troubles . . . elimination of uneven tire wear resulting when brake drums wear out of true.

for cars, trucks, buses, tractors, aircraft and industrial machinery

Lambert Disc Brakes

Air • Hydraulic • Mechanical

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St. Joseph, Michigan • Windsor, Ont., Canada

1042

line, which stopped the flanger until a given weight of bodies was stacked in the conveyor, after which it started. This entirely eliminated the human element and released the operator for more important work.

Fatigue Elimination—Training—Part of Production Engineer's Job

Operator fatigue cannot be calculated, since it originates from so many different causes. It has been proven, however, that there is a particular limit, especially among female employes, beyond which production will suffer. Charts were kept for over a year on an assorting, packing and inspection operation on stamped parts, hand-fed to the employes. It was found that while a normal production of eight hours a day could be increased immediately on the start of a nine-hour shift, yet, after a period of six months, the production was less than that formerly obtained in eight hours. Return to the eight-hour shift again brought production up. These facts have been proved in many industries on many different products.

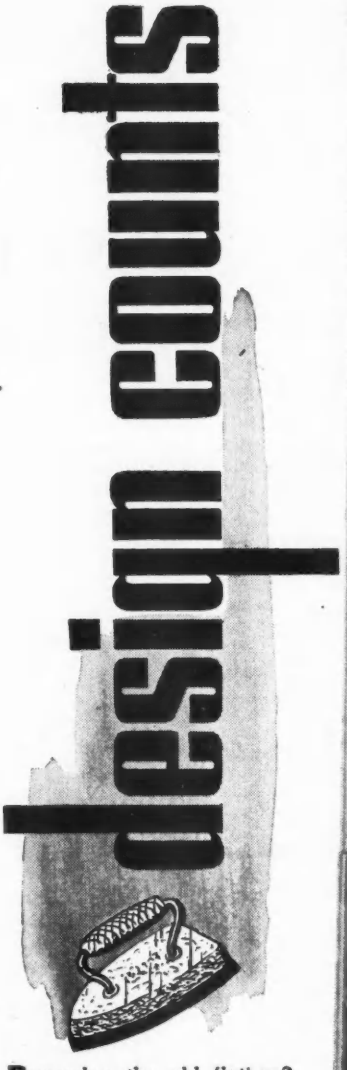
Training is important and the particular characteristics of employes must be considered. In one plant, precision parts made of high-grade steel corroded in stock, even though protected by an oil coating. It was found that an employe doing the cleaning prior to the coating had an acid condition, and his fingerprints on the parts prior to greasing were causing the trouble. In another case, a lithograph concern had trouble in matching its colors on one particular shift, almost every job with pastel shades being a considerable amount off color. Much work was done before it was decided to give each employe a color-blindness test, and, when completed, it was found that all had passed except the foreman on the particular shift where the trouble originated.

Production engineers cannot analyze for one condition, or many reoccurring problems like those we have outlined here will develop. It is true also that no man can anticipate all the problems which may occur with a given problem so that hindsight must always be used, but through coordination the problems of design, tooling and production personnel; by establishing standard practices and by conducting research apart from production, the production engineer can, if he will, reduce the amount of hindsight required. Only experience can indicate pitfalls such as have been described and even then these cases do not all indicate that experience was not present. We can learn from these cases, and realizing that we will get them again and again, direct our thinking properly so that the end result will be production and, above all, harmony.

The best "soft" hammers and mallets are rawhide—tough, resilient, long-lasting C/R mechanical rawhide. They strike effective blows without battering or marring . . . without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.

Write for Catalog Sheets.

CHICAGO Rawhide MFG. CO.
1310 ELSTON AVE. ★ CHICAGO, ILLINOIS.



Remember *the old flatiron?* It did its job, of course; but just compare it with the modern electric iron which has been brought to its present high level of utility by careful application of design.

Here at **THE WARD PRODUCTS CORPORATION,** design is one of the most carefully considered factors in the manufacture of antennas. It is only through superior design that durability, styling and the benefits of superior production can be best brought to the user. For the finest antennas for all applications — for home and automobile use — look to **WARD.**

Back Again . . . Soon
WARD Aerials
"World's Finest for Car and Home"

WARD Antennas

BUY WAR BONDS

THE WARD PRODUCTS CORPORATION
1523 EAST 45TH STREET • CLEVELAND, OHIO

Suit of Armor

FOR A VITAL AIRCRAFT PART

LUMARITH*

Spiral Wound Containers for Strength and Lightness

PACKAGING delicate carburetor mixture controls for shipment to remote places was a real headache to a leading war production plant. Complaints poured in about parts ruined through dents from chipping hazards.

What to do? The walls of this part are only .003" thick, almost frail as an eggshell. Naturally the producer bought the sturdiest packaging available—or so he thought.

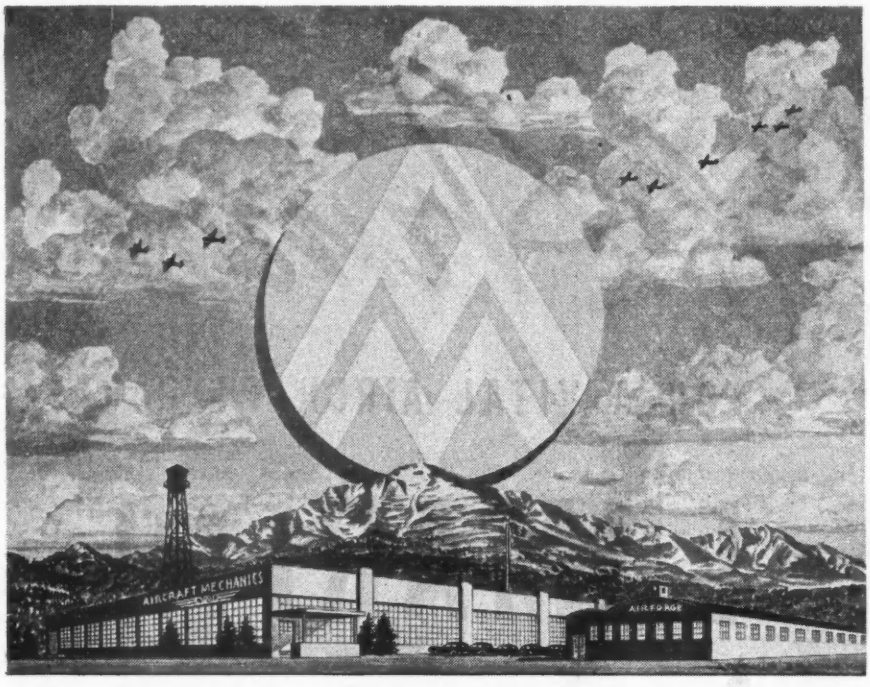
Then along came Precision Paper Tube Company of Chicago with a container of spiral wound Lumarith—and the parts maker's troubles were over. Now these protective Lumarith tubes carry delicate controls all over the world.

The package is 3" long and 1½" diameter. Discs of Lumarith are snapped into the base and cover and the ends are spun over to make a tamper-proof seal. The package is rigid—and so strong that on end it can support a man weighing 200 lbs.

Look into spiral wound Lumarith for any package needing exceptional strength and lightness and which can be tubular. Available in round, square or elliptical shapes and can be fabricated on standard paper-tube packaging machines. Consult the Sales Development Department of Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

A Celanese Plastic*

*Reg. U. S. Pat. Off.



OVER 50 MAJOR AIRCRAFT COMPANIES
ARE SERVED BY OUR PLANT....
Situated in the Famous PIKES PEAK Region!

Precision manufactured structural assemblies and steel forgings for aircraft are being produced in the heart of one of the world's most famous summer playground areas—the Pikes Peak region of Colorado.

Development here of an enterprise which is producing for Uncle Sam's Army and Navy air arms did not just happen! Our planning purposefully included the selection of Colorado Springs because of its ideal year-around climate and working conditions . . . because of the wealth of manpower available . . . because of excellent transportation facilities for supplies and finished products . . . and—because, personally, all of us long ago were convinced that the area offered many plus-opportunities for an engineering and manufacturing enterprise.

Today, our efforts are devoted to the production of war goods. Tomorrow, our ability, experience and ingenuity will be devoted to civilian production.

Meanwhile, if it is your plan to visit the cool and delightful Pikes Peak region this summer, let us invite you also to visit our plant, and inspect for yourself the engineering and manufacturing facilities we offer.

BUY UNITED STATES WAR BONDS AND STAMPS

★ **AIRCRAFT MECHANICS** INC.
COLORADO SPRINGS, COLORADO

DESIGNERS ▲▲▲ ENGINEERS ▲▲▲ MANUFACTURERS

Surface Treatments For Gear Teeth

(*Continued from page* 40)

erable relief (about 0.001 in. at tip and root), to discourage scuffing.

In the direct scuffing tests a medium-viscosity, straight mineral oil was used as lubricant, being supplied in a small jet directed at the point of entry into mesh. Oil was supplied at 158 F, and the gears did not dip into the oil. In each test the gears were run under very light load until the oil temperature became constant, and the load was then increased in steps, beginning with 1450 lb per in. face width, and increasing in steps of 306 lb per in. of face width, each load being maintained for five minutes. This was continued until scuffing occurred. The ratio between this scuffing load and that for untreated gears was taken as the criterion of the effectiveness of the treatment.

To test the wearing or lasting qualities of the surface treatment, treated gears were run for 100 hr at a load of 2670 lb per in., and then given the scuffing test described in the preceding paragraph. During the 100-hr test the gears were copiously lubricated, the load carried being about 80 per cent of the scuffing load for untreated gears when sparsely lubricated.

The endurance tests served to determine whether the surface treatments had any noticeable effect on the fatigue life of the gears. An attempt was first made to run these tests on relieved-profile gears of ¼-in. face, in accordance with a standard British material test, and the tests were repeated on gears of 3/16-in. face. It was hoped in this way to produce failure by compressive fatigue (pitting), but in every case failure occurred by bending fatigue (tooth breakage).

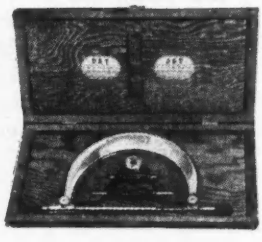
Preliminary direct scuffing tests were made on untreated gears and gears with deep-phosphate (manganese), shallow phosphate (zinc), caustic soda-sulphur, tin-plate and colloidal graphite treatments. Assigning a figure of merit of 1.00 to the untreated gears, the figures of merit for the different

(*Turn to page* 104, *please*)

D&T MICROMETERS AND SNAP GAGES

Davis and Thompson RotoMatic

Tubular welded frames with forged ends insure a maximum of accuracy with a minimum of weight. There are a variety of types available with either micrometer heads or dial indicators to cover a range of capacities from 0 to 168 in. . . *Write for Bulletin 200* or outline your gaging problems.



• D & T Bow Micrometer
0 to 6 in. capacity

Davis and Thompson Co.
Mfrs. of Machine Tools and Micrometers
6411 W. Burnham St. Milwaukee 14, Wisconsin

MILLHOLLAND

Automatic **DRILLING - BORING MILLING - TAPPING** Units

½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
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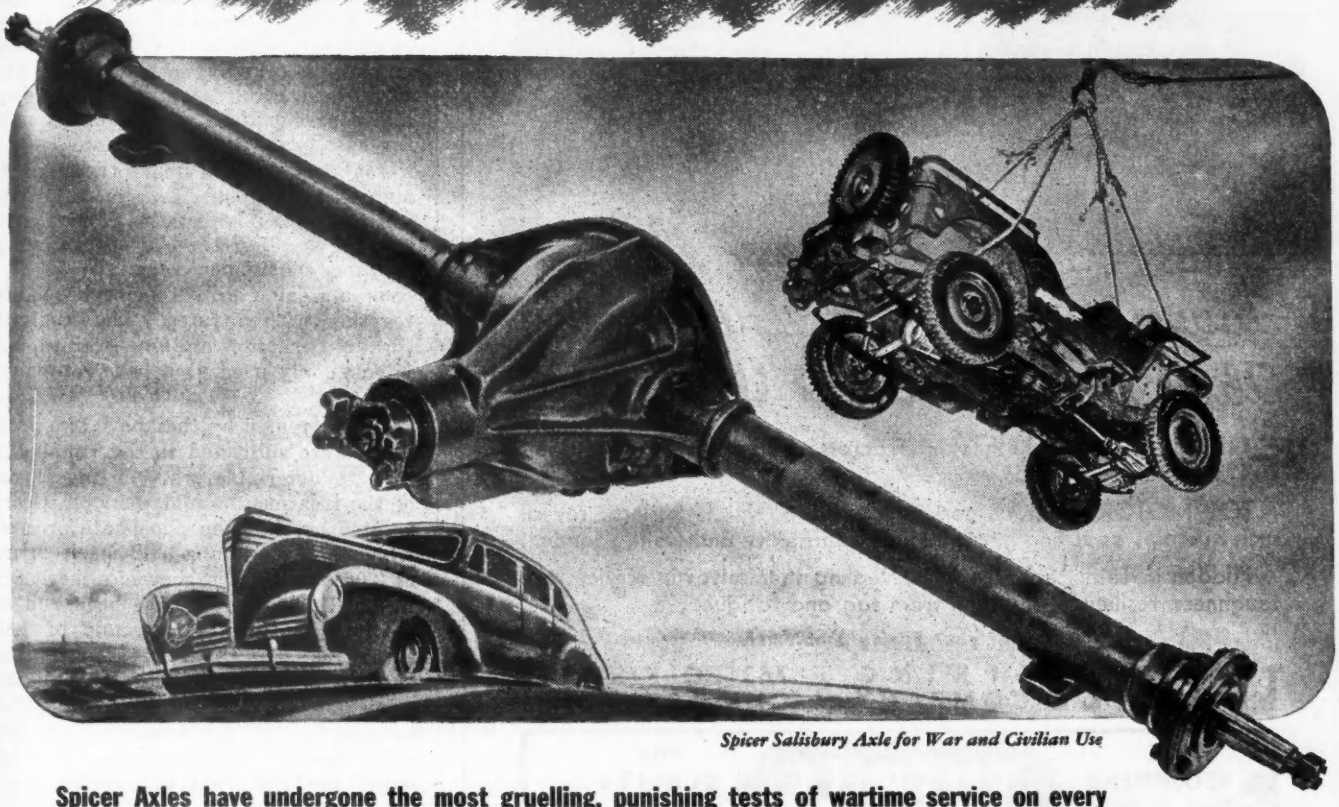
Spicer Automotive Axles

with a distinguished war record...

now ready for peace!



Spicer Salisbury Axle for War and Civilian Use

Spicer Axles have undergone the most gruelling, punishing tests of wartime service on every front. They were quickly adapted to military passenger and heavy-duty service with little change —fitting testimony to the correct design and strength which long have been recognized in Spicer peacetime products. Special features of the Spicer Salisbury Rear Axle illustrated include:

PERFORMANCE

Quietness over long periods assured by extreme rigidity in mounting gears and bearings; by very careful ribbing; by completely backing up differential bearings to take thrust load; and by very close tolerances in manufacturing and adjusting.

LUBRICATION

Special cover and oil channels assure adequate flow of lubricant to gear and pinion teeth, pinion bearings, differential bearings and internal gears, at all speeds and covering a wide range of viscosity, and at various oil levels.

FLEXIBILITY OF INSTALLATION

With slight changes requiring only very small tool charges, the axle may be adapted to various cars with different treads, spring centers and brakes or loads, by changing tube length, wall thickness and axle shaft length, spring pad location, etc.

WEIGHTS

Low unsprung weight has always been considered of great importance in regard to riding qualities, therefore this factor was carefully considered. With the Spicer Salisbury Axle, there is approximately 15% to 20% saving in weight over the conventional construction.

SERVICEABILITY

The cover is made easily removable so that the gears or bearings may be inspected or other service work done. Both oil filler and drain plug are provided so that axle may be completely drained, flushed and refilled at any time.

Let Spicer deliver the goods for your power-delivery needs. Spicer Manufacturing Corporation, Toledo, Ohio

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treated gears were 2.22, 1.46, 1.29, 1.00 and 1.21, respectively. From this it will be seen that the two phosphate treatments, deep and shallow, respectively, gave by far the greatest protection, and it was therefore decided to confine further investigations to phosphate treatments, particularly because these are commercially available in a variety of forms, and are in use for other purposes in many plants. The two treatments referred to may be described as follows:

(*a*) DEEP PHOSPHATE TREATMENT—A phosphate treatment involving the immersion of the parts for 45 minutes at 204 F-208 F in a proprietary solution consisting essentially of ferrous and manganese dihydrogen phosphates. The resultant coating is comparatively deep and coarse-grained, and is much used for rust prevention.

(*b*) SHALLOW PHOSPHATE TREATMENT—A phosphate treatment involving the immersion of the parts for 10 minutes at 180 F-185 F in a proprietary solution consisting essentially of ferrous and zinc dihydrogen phosphates together with nitrates. The resultant coating is shallow and fine-grained, and is commonly used as a base for painting.

Gears treated by the above two processes were subjected to the running-in test, to determine whether the effects of the treatment would wear off. Gears treated by the deep phosphate process, which had a scuffing-load merit figure of 2.06 at the start, showed a merit figure of 1.66 after having been run at medium load for 40 hr, and of 1.36 after 100 hr. Gears treated by the shallow phosphate process showed the same merit figure of 1.46 after 40 hr running as at the beginning. However, the falling off in the figure of merit for the deep phosphate treatment, observed in these preliminary tests, was not repeated in later tests, a fact for which the investigators had no adequate explanation. It was also noticed during these preliminary tests that a considerable change in the profile shape took place in gears given the deep phosphate treatment, which was

(*Turn to page* 106, *please*)

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* Constant velocity through 38° in standard models, through 45° in special models.

TRACTA JOINTS are ideally suited to front-wheel drives, multiple-drives, independently-sprung wheels, half-tracks and caterpillars. Valuable also for railroad inter-car drives, marine and aircraft applications, for machine tools, power take-offs and conveyors.

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Syracuse 1, N. Y.

due to the wearing away of the comparatively deep surface coating. There was practically no measurable change in shape in gears given the shallow surface phosphate treatment.

The main tests were carried out on untreated gears, gears treated by the two phosphate processes described above (referred to as treatments *a* and *b*), and by a number of variations of these processes described as follows:

(*f*) A low-temperature phosphate treatment in which parts are immersed in a proprietary solution of zinc dihydrogen phosphate plus nitrate for 20 minutes at a temperature of 110 F-120 F.

(*h*) A phosphate treatment involving the immersion of the parts for 30 minutes at 208 F-212 F in a proprietary solution consisting essentially of ferrous and manganese dihydrogen phosphate.

(*i*) A phosphate treatment involving immersion of the parts for 5 minutes at 167 F-185 F in a proprietary solution consisting essentially of zinc dihydrogen phosphate together with an accelerating agent.

(*j*) An accelerated phosphate treatment similar to treatment (*a*). Immersion time 15 minutes at 190 F-195 F.

(*k*) The same as treatment (*b*) but with 30 minutes immersion time.

The results of the direct scuffing tests are given in Table I.

TABLE 1—RESULTS OF DIRECT SCUFFING TESTS

Code Letter	Surface Treatment Type	Mean Scuffing Load lb./in. face	Ratio, Treated / Untreated
..	Untreated	3,300	1.00
(a)	Deep Phosphate (Manganese)	6,770	2.05
(b)	Shallow Phosphate (Zinc)	4,500	1.36
(f)	Cool Shallow Phosphate (Zinc)	5,310	1.61
(h)	Deep Phosphate (Manganese)	6,940	2.10
(i)	Shallow Phosphate (Zinc)	4,960	1.50
(j)	Accelerated Deep Phosphate (Manganese)	6,870	2.08
(k)	Treatment (b) Prolonged (Zinc)	5,570	1.69

* Reference load.

It will be seen that the three deep phosphate treatments, (*a*), (*h*), and

(*Turn to page* 108, *please*)

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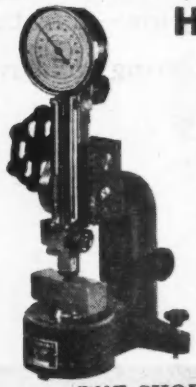

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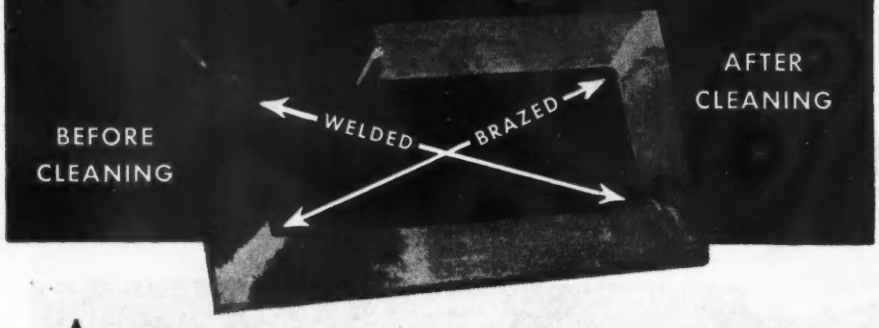
A NEW METHOD of removing flux, and welding or brazing scale



A highly satisfactory record removing flux, and welding and brazing scale has been hung up by OPTIMUS Deoxidant No. 3. It is being used to deoxidize the surfaces of a wide variety of metals and alloys.

Not a bright dip, and not intended to replace acid in ordinary pickling, OPTIMUS Deoxidant No. 3 being acidic in nature may be used on most metals as a mild deoxidant without serious etching of the surface. It is used regularly on welded steel tubing, brazed, hot rolled and cold rolled steel, copper, brass, welded aluminum, cast iron, bronze castings and most aluminum alloys.

As in the illustration above, in general, oxides are removed with the formation of very little or no smut, in contrast to the smutty surfaces frequently encountered. With the use of OPTIMUS Deoxidant No. 3 most welding and brazing scales are removed in from 5 to 15 minutes. Aluminum is deoxidized in 3 to 5 minutes; longer times tend to produce a smut with some alloys.

Material costs are low, using OPTIMUS Deoxidant No. 3, for consumption is largely a matter of replacing drag-out. No annoying or corroding fumes. Provides ease of operation; simply deoxidize for the required time; give work a quick rinse in hot water and the job is done.

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FOR INDUSTRY

(*j*), gave the greatest protection, with figures of merit of just over 2.00. All of the gears were subjected to the 100-hr running-in test, and the subsequent scuffing tests showed that as compared with the direct scuffing tests the ratio "scuffing load/reference load" was changed as follows:

With untreated gears, reduced from 1.00 to 0.85.

With gears given treatment (*a*), reduced from 2.05 to 2.03.

With gears given treatment (*b*), increased from 1.36 to 1.50.

With gears given treatment (*f*), reduced from 1.61 to 1.09.

With gears given treatment (*h*), reduced from 2.10 to 1.98.

With gears given treatment (*i*), reduced from 1.50 to 1.25.

With gears given treatment (*j*), reduced from 2.08 to 1.87.

With gears given treatment (*k*), reduced from 1.69 to 1.18.

It is pointed out in the report that the general reduction of the figure of merit after running in does not conform to the generally accepted belief that the load capacity of a pair of gears is increased by running in at a medium load. It will be seen that in this test, also, the three deep phosphate treatments, (*a*), (*h*), and (*j*), are still the best.

Endurance tests were also run, to determine whether the treatments had any effect on the fatigue life, but, as already mentioned, in all of these tests the gears failed by tooth breakage, and none by pitting.

In the course of some of the tests, steps were taken to ascertain the wear on the teeth during the 100-hr. run. Profile measurements were made on a Sykes involute tester at the beginning and end of the 100-hr run, but these measurements by themselves were found to be not an entirely satisfactory indication of the wear which had taken place. With the deep phosphate treatment, in particular, there appears to be an appreciable "build-up" on the surface of a crystalline coating which is comparatively soft, and which is rubbed off quickly. The nature of this coat-

(*Turn to page* 110, *please*)

B·H

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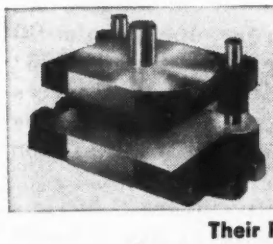

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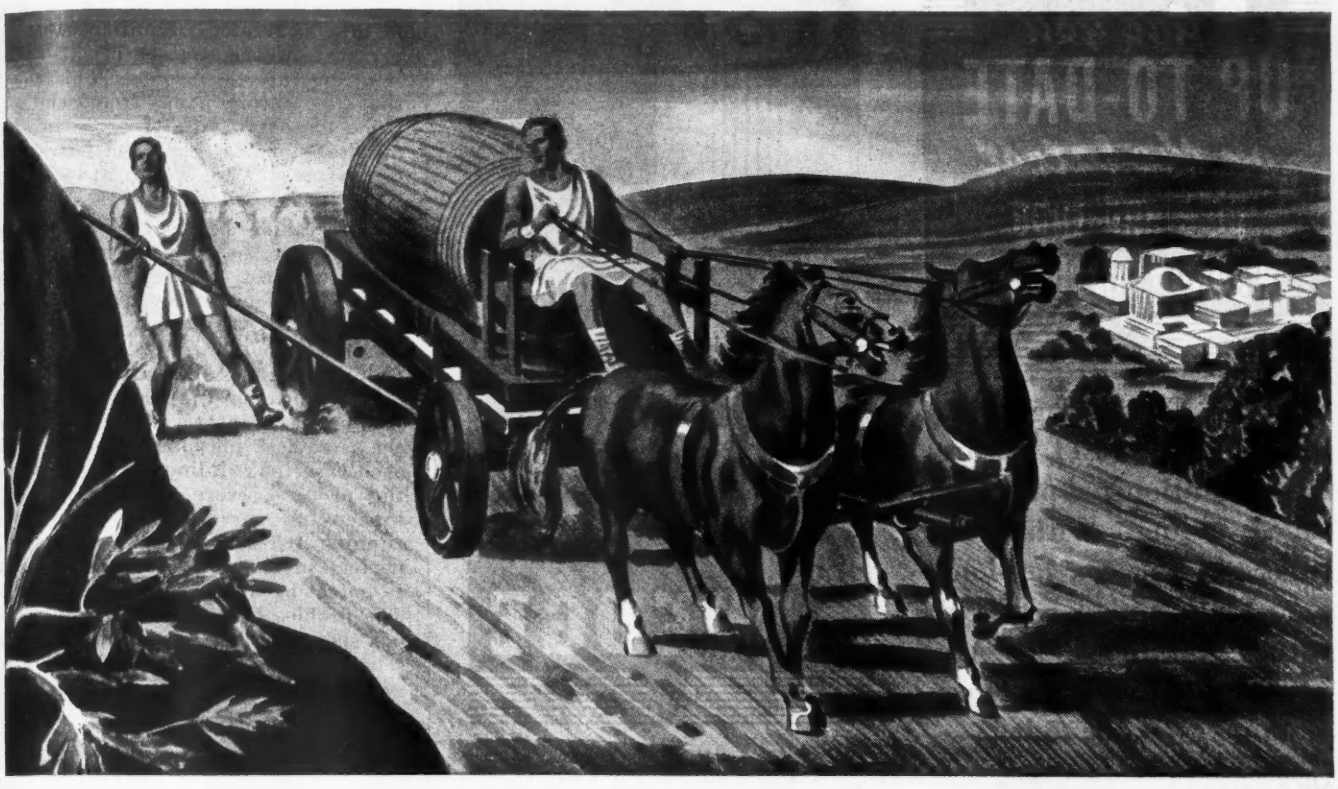

It took a Sufflamen to slow down Lateranus

Sounds like double-talk, doesn't it?

Actually, Lateranus was an early Roman living in the first century. And "sufflamen" was the Latin word for brake. The word means "a blow under" which implies that the first brake was a pole or a wedge driven under a wheel.

Later, the Romans figured out other kinds of braking devices to keep their carts from zipping down the mountains of Italy at a dizzy pace. But their problem was simple compared to the job of building brakes for the automotive vehicles of today. Automotive engineers deserve great credit for their work in developing good brakes.

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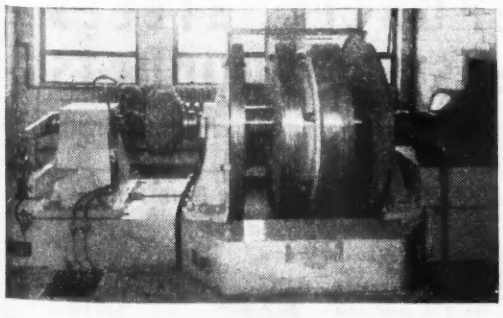

Heavy Duty Brake Dynamometer in American Brakeblok laboratory. This machine is used for testing brake equipment for heavy trucks and buses.

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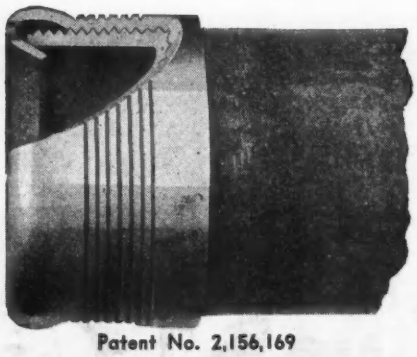

Patent No. 2,156,169

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ing makes measurements with th Sykes instrument difficult on the gea in the "as treated" condition, since th pressure of the contact needle cause it to dig into the profile. This mean that the datum point from which t make measurements, viz., the involu profile extending from the base circl up to the lowest working depth, be comes rather indeterminate.

With the deep phosphate treatment also, despite the consistently good pro tection against scuffing, the wear indi cated by profile measurments showe considerable variations between on batch and another. Figs. 1 and 2 sho profile diagram taken after treatment and again after the 100-hr run unde medium load, in two different tests o the same deep phosphate treatment. I each case the full-line curves represen the profiles before running, and th broken-line curves the profiles afte running 100 hr. In these diagrams a perfect involute profile would be rep resented by a straight vertical line The profiles of two teeth on each gea are shown, and in Fig. 2 an additiona set of curves is shown chain-dotted representing the profiles after running for 1 hr. In Fig. 1 the wear is large while in Fig. 2 it is comparatively small.

The following conclusions were drawn from the results of the tests:

Of the various chemical and other surface treatments used for the preven tion of scuffing on piston rings or the like, the phosphate treatments appear to be most effective in inhibiting the scuffing of gears.

Of the various phosphate treatments in common use or available in industry those containing manganese phosphate *i. e.*, those which give a comparatively deep and usually coarse-grained coat ing, give the greatest protection against scuffing.

The application of one of these man ganese phosphate treatments to the al most unrelieved gears used in the IAE gear testing machine approximately doubled the load required to cause scuffing.

This improvement in load-carrying capacity imparted by the manganese

(*Turn to page* 112, *please*)

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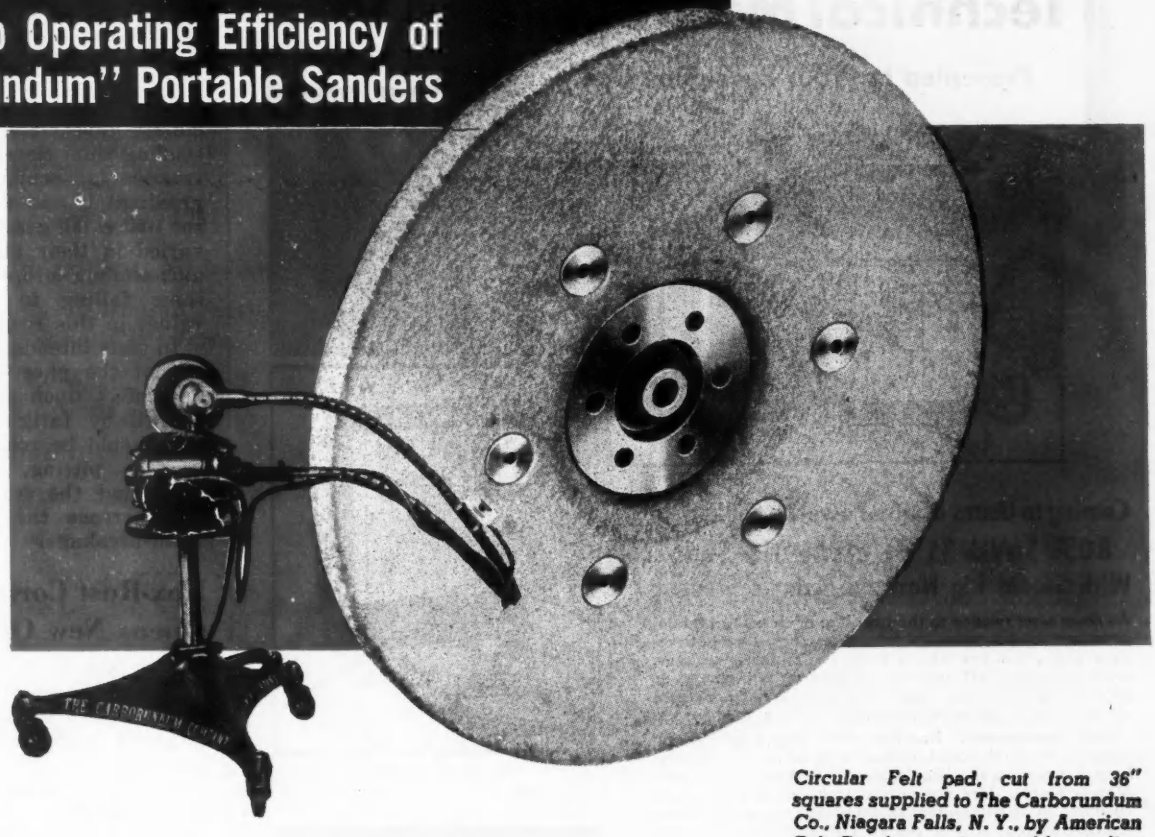

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The *business end* of a flexible shaft sander is the abrasive head. Supported by a balanced pad felt disk, the head is given a resiliency that assures greater sanding efficiency. Felt mounted abrasive heads make possible the:

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For helpful counsel, ask an American Felt Company Product Engineer to call; or write for Data Sheet No. 9 "Sheet Felts."

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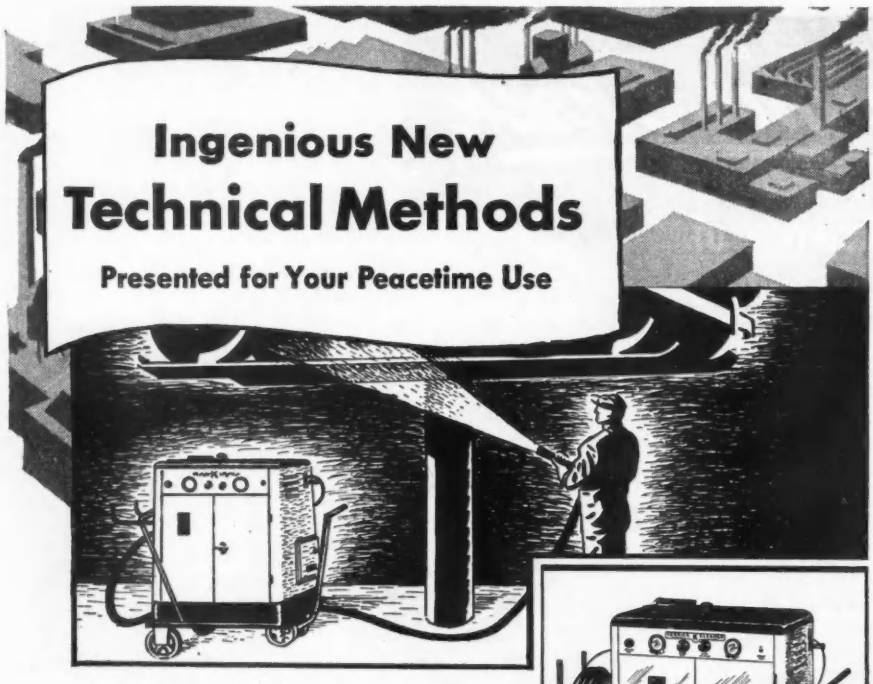

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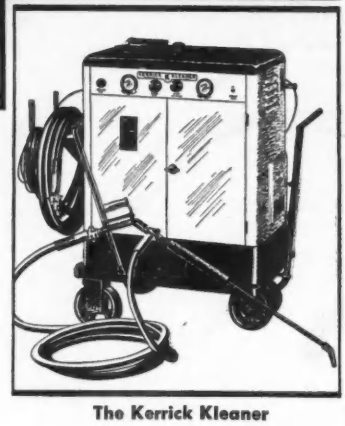
Wartime uses of Wrigley's Spearmint Gum also point the way that industry may benefit when this quality product again becomes available. It will *again* be a "help on the job" in many ways. Right now *no* Wrigley's Spearmint is being made, as present conditions do not permit the manufacture of Wrigley's Spearmint in quantity and quality sufficient for all. But remember the Wrigley's Spearmint wrapper—it is a certificate of highest quality and flavor—and will always remain just that.

You can get complete information from Clayton Manufacturing Company, Alhambra, Calif.



The Kerrick Kleaner

Remember this wrapper

Z-74

phosphate treatments was maintained after running the gears for 100 hours at about 80 per cent of the load required to cause scuffing of the untreated gears.

The amount of wear which took place during this 100 hours' running was rather greater than the amount of build-up on the surface which characterizes these treatments, but was limited to a few ten-thousandths of an inch.

The zinc phosphate treatments, as a class, gave less protection against scuffing than the manganese phosphate treatments, scuffing loads being approximately one and a half times those for untreated gears. These treatments varied in their ability to retain their anti-scuffing properties after running, some falling to disappointingly low values in this respect.

In tests intended to establish whether or not the phosphate treatments had any effect upon the liability of gears to fail by fatigue, no conclusive results could be reached, particularly as regards pitting, but the indications were that the surface treatments did not increase the liability to fail by tooth breakage.

Nox-Rust Corp. Opens New Offices

The Nox-Rust Corp., Chicago, announces the opening of a number of new offices. Sales quarters have been established in Buffalo in charge of C. R. Craig at 1200 Niagara St., and in Philadelphia, where L. J. LaBarge of the Commercial Warehouse Co., Meadow and Wolf Sts., is in charge. Waterbury, Connecticut, 531 Bank St., is managed by G. R. Angrave. A new sales office also has been opened in Cleveland at 14511 Woodworth Ave. T. C. White is in charge.

Armstrong to Build Research Laboratory

Plans are being formulated by the Armstrong Rubber Co. of West Haven, Conn., to establish a physical and chemical laboratory devoted exclusively to rubber research and development.

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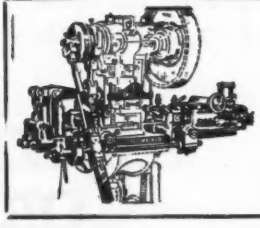

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